Cluster Tool

IBD/IBE

User Manual

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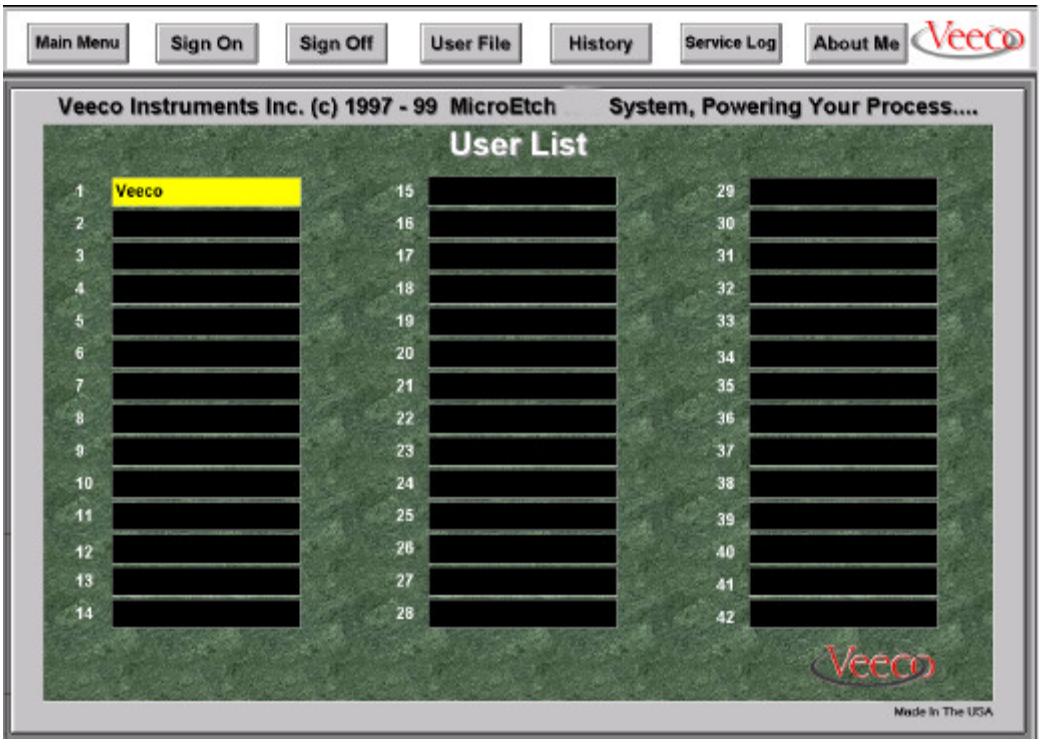
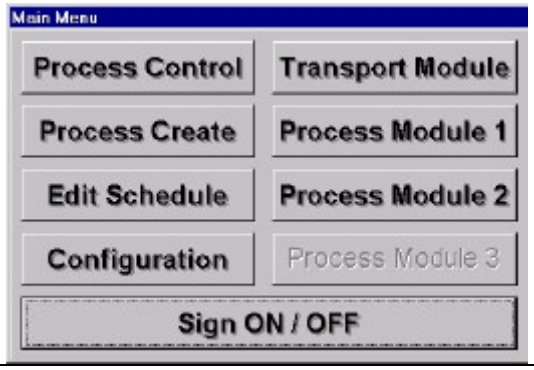
Sign On/Off Screen

Function:

This screen allows users to sign on and off. In addition, the System Supervisor can edit user names, ID numbers, designate privilege levels and exit the program. A history of the system use can also be displayed.

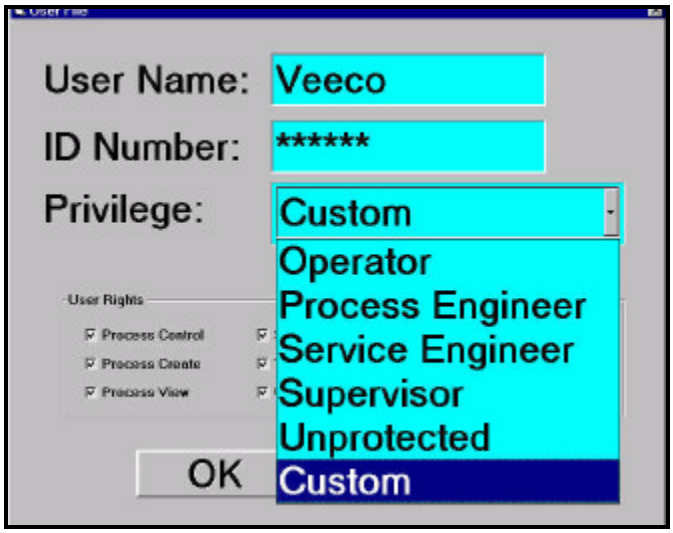


Button	Function
Main Menu	Returns the user to the Main Menu (after signing on).
Sign On	Signs the user onto the system at his/her privilege level.
Sign Off	Signs the user off the system.
User File	Assigns user, their privilege levels, and passwords to the system.
History	Displays a history of the system's users and their time signed on.
Service Log	Brings the user to the Windows Notebook text editor to allow data entry.
About Me	Displays software version number.

Sign On/Off Screen	**Main Menu**
	Function: Gives users access to the system's primary screens. 

Sign On/Off Screen	**Sign On/Off Menu**
Note When a new user signs on, the previous user is automatically signed off.	**Function:** All system users are required to sign on and off to access the screens available for each individual level of privilege (refer to Privilege Levels Defined). This screen allows the user to sign on and off the system at the assigned privilege level. **To sign on to the system:** 1. Click on the desired user from the User List. 2. Select SIGN ON 3. Enter your six-digit ID number and select OK. The following messages will appear: **89910 Welcome to Veeco's Microetch System** or **2002 Incorrect ID number** 4. If you are signed on, select the Main Menu. 5. If you have entered the wrong ID number, you cannot access the Main Menu. 6. Repeat steps 1-3. If still unable to sign on, contact Supervisor.

Sign On/Off Screen	**Sign On/Off Menu**
	To sign off: 1. Select SIGN OFF. 2. Select Yes to sign off. *Privilege Levels of Service Engineer or higher will be prompted to exit the program.* 3. Select Yes again to exit the application or No to allow another user to sign on.

Sign On/Off Screen	**User File Sub-Menu**
Access to this screen requires a privilege level of System Supervisor or higher.	**Function:** This screen allows the System Supervisor to add users and assign their privilege levels as well as remove users from the system. The System Supervisor can also assign unique privilege levels as per system requirements. 

Privilege Levels Defined

The system has (6) six levels of user privilege.

Each level permits different access to the software screens and limits control of the system.

Operator

When signed on to the system as an Operator, only the following functions are accessible:

1. Sign on and off the system.
2. Select the process to run from the Process Control Screen.
3. Put the system on and off line from the Process Control Screen.

Process Engineer

When signed on to the system as a Process Engineer, in addition to privileges of an Operator, on the following functions are accessible:

1. Create, edit, and delete processes from the Process Create Screen.

Service Engineer

When signed on to the system as a Service Engineer, in addition to privileges of a Process Engineer, only the following are accessible:

1. Configuration Screen to edit time, tilt, and source parameters.
2. Process Module Screen to control vacuum, fixture, FlowCool™, gas, and ion source and process parameters.

Supervisor

When signed on to the system as a Supervisor, in addition to privileges of a Service Engineer, the following functions are accessible:

1. Create, edit, and delete users from the Sign On/Off Screen.

Custom

The System Supervisor can assign special features to a user.

Unprotected

Allows access to all screens and all functions. All interlocks are bypassed and any command will be executed without warnings.

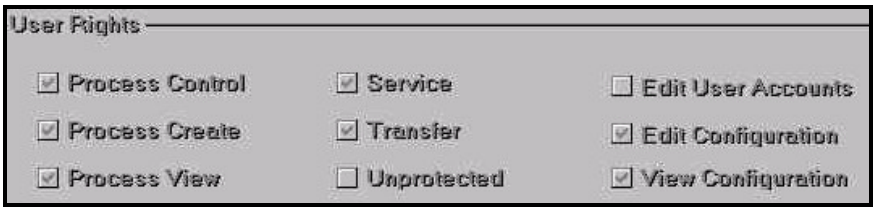
WARNING!

To prevent personal injury or damage to the equipment, use extreme caution when running the IBD System in the Unprotected mode. All built-in safety features and interlocks are disabled.

User Rights Defined

Function:

To assign user rights by privilege level. May be changed by the System Supervisor. Click to enable/disable selection.



Process Control	Allows access to the process control screen to select and run a process.
Process Create	Allows the user to create and edit process recipes.
Process View	Allows the user to view created process recipes, but not edit them.
Service	Allows Service Engineer to manually transfer and on/off, open/close, and run cycle to check wafers handling and to service the system for preventive maintenance or repair.
Transfer	Allows access to the Transfer Module screen.
Unprotected	Allows the user the ability to put the system the Unprotected Mode bypassing all safety and interlocks.
Edit User Accounts	Allows the user to assign and remove privilege levels and add and delete users.
Edit Configuration	Allows the user to edit the Configuration (containing system-specific settings) screens.
View Configuration	Allows the user to view the Configuration screens but not to edit its contents.

User File Procedures

Function:

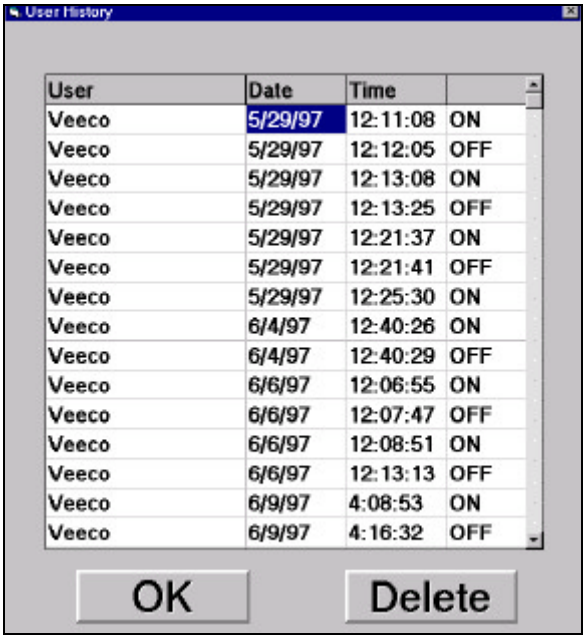
To define system users. To perform the following steps, the user must be signed on to the system at a privilege level of System Supervisor or higher. The user list can display a maximum of 18 characters.

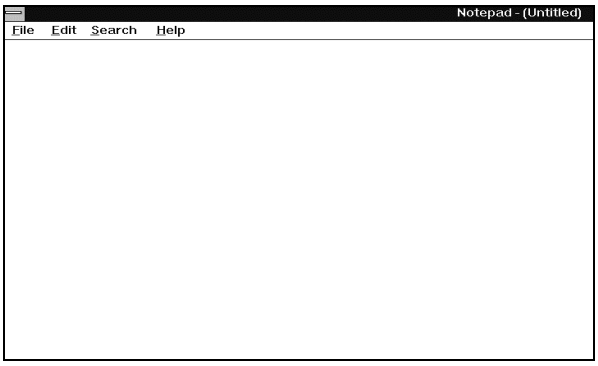
Modify a User's Setup

1. From the Main Menu, select SIGN ON/OFF.
2. Click on the user name to be changed.
3. Select USER FILE.
4. Type in the changes to the user name up to 20 characters. Enter the new six-digit ID number.
5. Click on the box for privilege level and select the new privilege level. A list of functions will be displayed for each level.
6. If selecting CUSTOM, highlight selections desired by clicking on the box next to the choice.
7. Select OK to keep the selections or cancel to exit the User File screen.

Deleting a User

1. From the Main Menu, select SIGN ON/OFF.
2. Click on the name of the user to be deleted.
3. Select for USER FILE.
4. Highlight the user name and delete it.
5. Select OK to keep the selections or cancel to exit the User File screen.

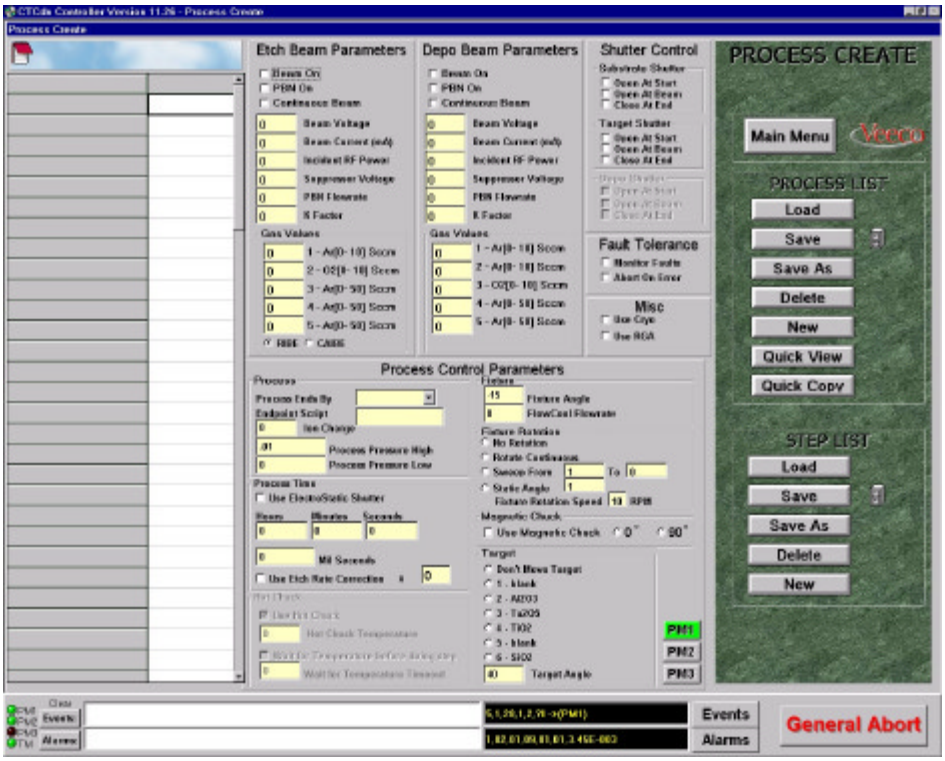
Sign On/Off Screen	**History Sub-Menu**
Note *Privilege level of System Supervisor or higher required to access this function.*	**Function:** Displays the history of the system users, including name, date and time of signing on and off. **Accessing User History** To display the System's User History: 1. From the Main Menu, select SIGN ON/OFF. 2. Select User History. *A list of all previous users and their Sign On/Off dates and times is displayed. Scroll to see the complete list.* **Deleting User History List** To delete the entire list: 1. Select Delete. 2. Select Yes when Delete User File History? message displays. 3. Select OK to return to SIGN ON/OFF menu. 

Sign On/Off Screen	**Service Log Sub-Menu**
Note: *All files saved are automatically given the extension .txt.*	**Function:** Used to access the Notebook program text editor in Windows®. This allows the user to enter service-related data in text format into the Windows® Notebook. **Creating a Service Log** To create a Service Log: 1. From the Sign On/Off Screen, select Service Log. *You are now in the Notepad (Windows Program).* 2. Type the information you want to enter in your Service Log. **Saving a Service Log** To save a Service Log: 1. Click on File. 2. Click on Save 3. Type in the name you want to give to your service file. 4. Click on OK. *The file is now saved.* **Accessing a Previously Saved Service Log:** To access a previously saved Service Log: 1. From the Sign On/Off Screen, select Service Log. *You are now in the Notepad (Windows Program).* 2. Click on File. 3. Click on the name of the file you want to access. 4. Click on OK. 5. The Service Log file is now opened and can be added to or edited. 6. Save all changes (follow above *Save* procedures). 7. Select File and click on Exit when completed.  New Service Log When Opened.

Process Create Screen

Function:

To create **steps** that detail system operating parameters and to insert these steps into a sequence called a **process**.



Steps

Each **step** within the process details all the information needed by the system to perform the etch operation, including beam, gas, and control parameters. Once defined, steps are inserted into a process.

Process

Each **process** is assigned a unique name by the user and is permanently stored on the system's hard drive allowing the user access and editing functions when desired. The user also has the ability to select any set of steps and create any number of new processes for specific applications. Once a new process is created, it is also permanently stored, and can be run by an operator through simple menu selections.

Since the CTC hard drive stores process, configurations, and INI files, it is important to back up these files.

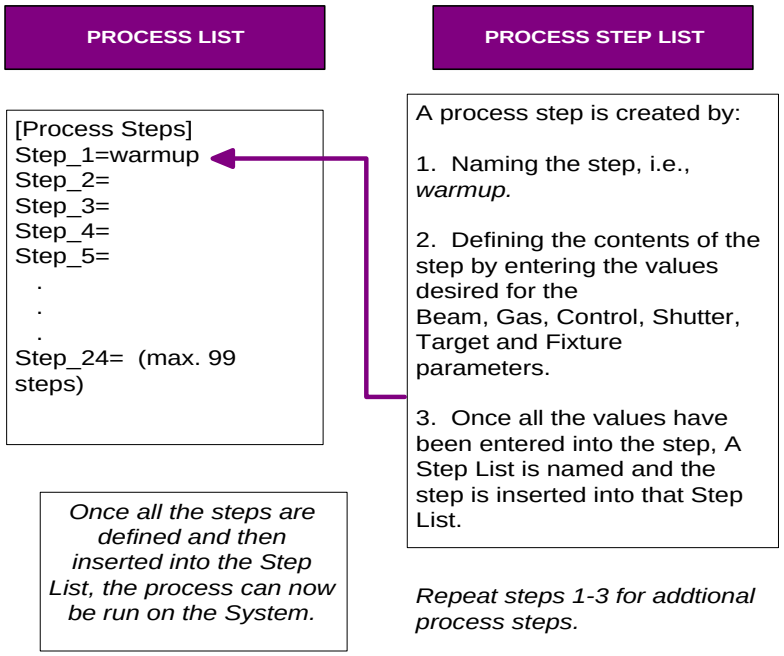
Process Create Screen

Illustrated to the right are the functions performed when creating steps and inserting them into a process.

Note:

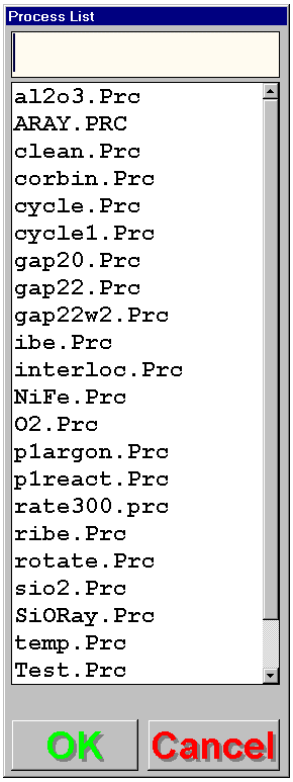
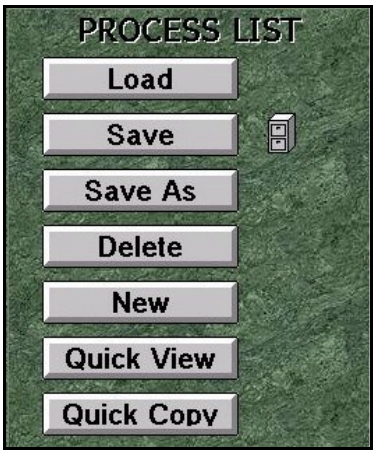
The values displayed in this illustration are not <u>true</u> values and therefore should not be used to reflect operating conditions.

Process Create Overview


PROCESS LIST
PROCESS STEP LIST
[Process Steps]
Step_1=warmup
Step_2=
Step_3=
Step_4=
Step_5=
.
.
.
Step_24= (max. 99 steps)
A process step is created by:
1. Naming the step, i.e., warmup.
2. Defining the contents of the step by entering the values desired for the Beam, Gas, Control, Shutter, Target and Fixture parameters.
3. Once all the values have been entered into the step, A Step List is named and the step is inserted into that Step List.
Once all the steps are defined and then inserted into the Step List, the process can now be run on the System.
Repeat steps 1-3 for addtional process steps.

Before Proceeding With Process Create

Before proceeding to create or edit a process, review the following pages that describe the programmable parameters (gas, beam, control, and elevator) of the process step.

Process Create Screen	Menu Selections	
Function: Performs file management of process lists and step lists.  **A Sample Process List**	 	**Main Menu** Returns the user to the Main Menu
	 	**Load** Loads a previously created process list. **Save** Saves the current process list. **Save As** Saves the current process list with a new user-defined name. **Delete** Deletes the current process list. **New** Create a new process list. **Quick View** View an entire process in a spreadsheet format. No changes can made to the recipe. **Quick Copy** Copy entire process list to an external source such as a floppy disk.
	 	Load Loads a previously created step list. **Save** Saves the current step list. **Save As** Saves the current step list with a new user-defined name. **Delete** Deletes the current step list. **New** Create a new step list.

Process Create Screen	How to Create a Process
1. Create the Process Step ***Note:*** *Editing a previously created process step is detailed on the next pages.*	To create a **new** process step (which will later be inserted into a process step list), perform the following: 1. From the Main Menu select PROCESS CREATE. 2. Select New. 3. Enter the name for the new process, up to eight (8) letters. 4. Click OK. *An extension of .stp is automatically attached to the process name.* *A list of process parameters is displayed (with the system's default parameters listed) for Process Engineer to fill in.* 5. Select OK. 6. Enter the user-defined parameters by moving the cursor down to each line and entering the desired value or Y/N option. *For a description of these parameters and their ranges, refer to Process Step Parameter Tables previously listed.* 7. Move the cursor down and enter all the desired values. 8. Press Save to save the step. 9. After all the values have been entered, repeat steps 1 to 8 for additional steps. *When all the steps have been defined, they can be inserted into the Process List.*
2. Insert Steps into Step List	To insert steps into a Step List, perform the following: 1. Select New to create a new Step List. 2. Enter the name for the new Step List, up to eight (8) letters. 3. Click OK. *An extension of .lst is automatically attached to the process name.* *The Process Step List is displayed.* 4. Double click next to each step number to insert the displayed step. 5. To insert a different step, select Load, a list of previously created steps will be displayed. 6. Click on the desired step, and select OK. 7. Once the step is displayed it can be entered into the list by double clicking next to the step number. Repeat steps 5-7 for all steps needed to create the process. Press Save to save the list. The process can now be run.

Process Create Screen	**Editing Existing Steps or Step Lists**
Step Editing	To edit a previously created step: 1. From the Main Menu select PROCESS CREATE. 2. Select Load. *The screen displays a list of previously created steps.* 3. Double click on the step to be edited. 4. Move the cursor down and change the desired gas, beam, control, or fixture parameters. 5. Select Save.
Step List	From the Main Menu select PROCESS CREATE. 1. Select Load. *The screen displays a list of previously created lists.* 2. Double click on the step list to be edited. 3. Load a previously created step or create a new step. 4. Double click on the step number to be changed. *Note that the displayed step will be entered into the step list.* 5. Repeat steps 3-4 for additional changes to the step list. 6. Select Save to save. *After all steps are entered, the process can be run.*

Process Create Screen	**Deleting a Process or a Step**
Deleting a Process or a Step	Once a process or process step is deleted, it cannot be recovered. A Windows®-based file recovery program may be used. Consult Veeco Technical Support for additional information. The Delete function allows process list or process step to be deleted. To delete a process or step: 1. Select Load for either Process Step List or Step. 2. Scroll to see complete list and select the process or step to be deleted. 3. Select OK to display process or step. 4. Select either Process Step List or Step. 5. Press the Delete key to erase the process step list or step. 6. Select Y to delete or N to cancel deletion.

Process Create Screen

In creating the process, the user first defines the gas, beam, and control parameters for each step.

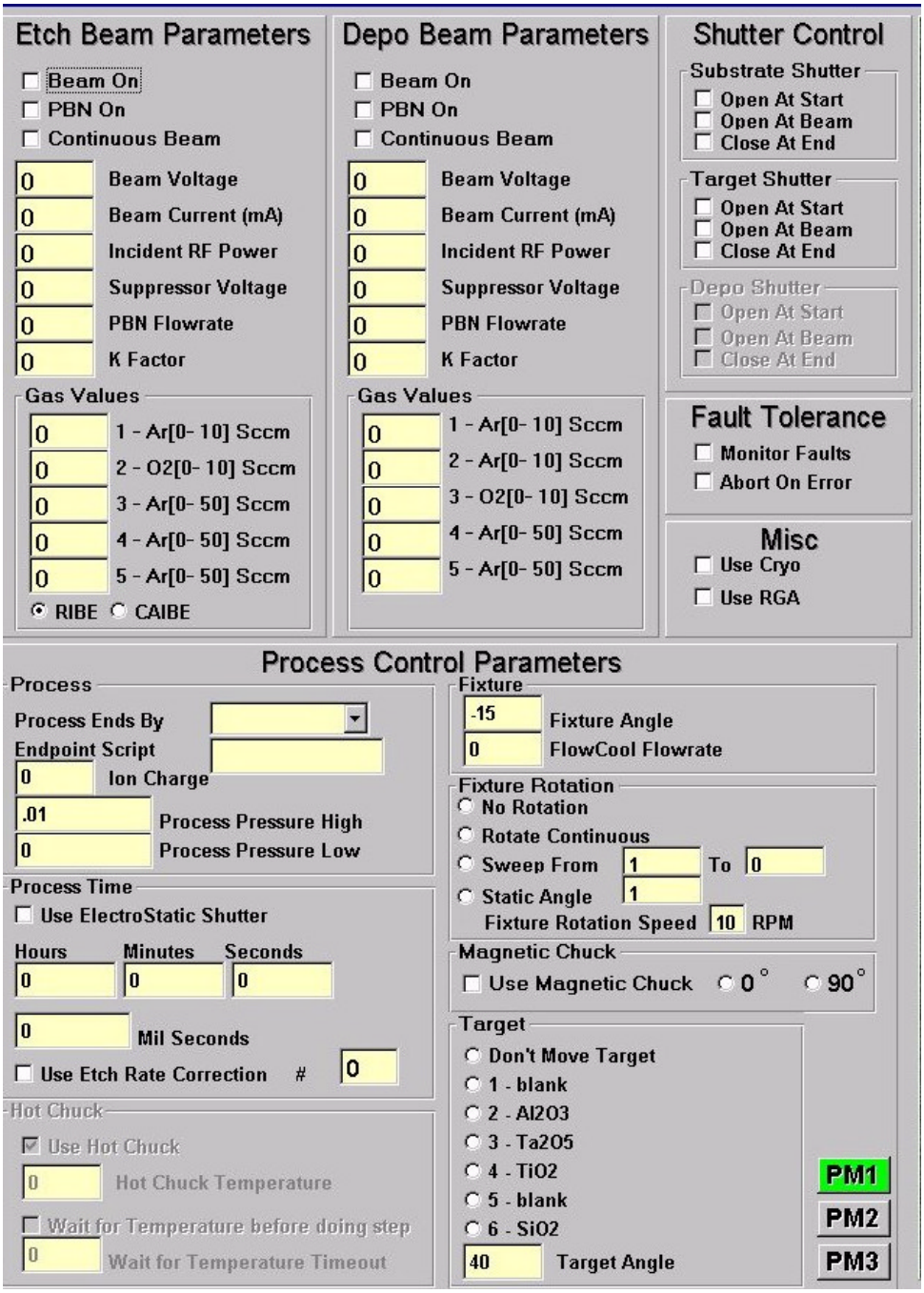
These parameters are detailed in the following tables along with their initial settings.

Notes:

Passing the mouse over a field will display the minimum and maximum value for that field.

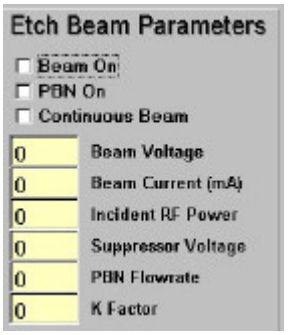
These parameters are defined for PM1. Note that the PM1 indicator is green in this example.

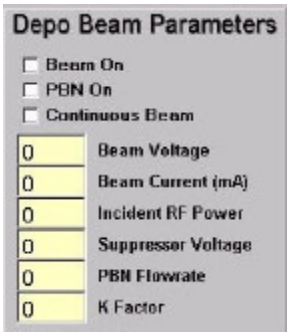
Step List Parameters



The Hot Chuck parameters are also grayed out in this example because this option was not available. Under certain applications, this option may be available. If so, the user may define the hot chuck's temperature as well as timeout parameters.

Process Create Screen	**Beam Parameters**





Beam On

When checked, causes beam to extract its plasma.

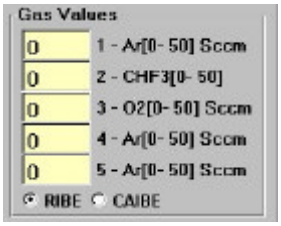
PBN On

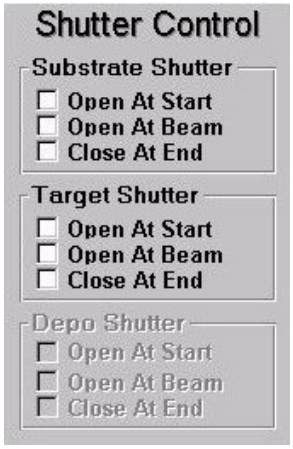
When checked, applies power to the PBN and the power remains applied during the step after beam stabilizes. If not checked, during the step, the PBN shuts off after the beam stabilizes.

Continuous Beam

Used in multi-step processes. When checked, causes the beam to remain on after the step.

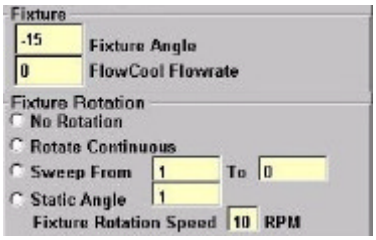
Parameter	Range	Default	Description
Beam Voltage	0 - 1000V	0	Voltage level of the applied beam.
Beam Current	0 - 1500mA	0	Current level of ion beam.
or			
Beam Voltage	0 - 1500V	0	Voltage level of the applied beam.
Beam Current	0 - 1000mA	0	Current level of ion beam.
Incident RF Power	0 - 2000W	0	Initial RF Power output level of RF Generator. Automatically adjusts when process is run.
Suppressor Voltage	0 - 1000V	0	Voltage level applied to the suppressor grid.
PBN Flowrate	0-10 sccm	0	Amount of Argon applied to the Plasma Bridge Neutralizer.
K Factor	0.3 - 5	0	Relationship between the PBN body current and beam current determined by the formula: $K = I_{PBN} / I_{BEAM}$

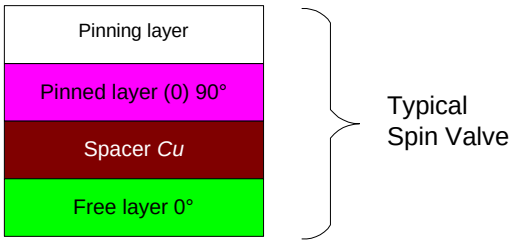
Process Create Screen	Gas Parameters
	**Function:** Controls the gas flow for each channel. Gas-type labels are defined in an external .ini file. Flow range labels depend on the mass flow controllers installed at each channel. To define or change the gas flow value, enter the value in the yellow field next to the desired channel label. Click on RIBE (reactive ion beam etch) or CAIBE (chemically assisted ion beam) to define the process type in the IBE module. This does not apply to the deposition module

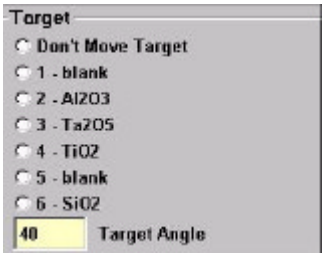
Process Create Screen	Shutter Controls	
Function: Controls shutter position during the process. When the shutter is closed it covers (blocks) the beam. At the beginning of a step, the shutter position can be opened or closed, and is controlled by checking the appropriate box.	 Target shutter applies only to the deposition module. The depo shutter is not used on GMR tools.	**Open At Start** If checked, when the step starts, open the shutter. If not checked, shutter will close. At Start information regarding the step is read from the hard drive (fixture, power supply, gas, etc.) time start telling device all is ready. (30 seconds to 2 minutes). **Open At Beam** When the beam is stable, open the shutter. If not checked, shutter will close. At Beam conditions - all devices are ready to do step, shutters can be moved, and the counter starts. **Close At End** Close the shutter at the end of the step when 0-process time remains. Coordinated with shutter position for the next step.

Process Create Screen	Fault Tolerance	
Function: To monitor and/or stop step in the event of a system fault.		**Monitor Faults** When selected, the steps will be monitored and warnings will be issued if a fault occurs as defined through the Configuration screen, Fault Tolerance page. **Abort On Error** When selected, stops the current process in the event of an error condition as defined through the Configuration screen, Fault Tolerance page. Refer to the Configuration screen section of this manual.

Process Create Screen	Misc.	
Function: Select this to use a cryo pump and/or RGA (residual gas analyzer) in the process.		**Use Cryo** If a cryo pump is installed, check to have cryo gate valve open during the step. **Use RGA** If an RGA is installed, check to have the process look at the RGA output at the end of the step to determine if the step is within RGA parameters.

Process Create Screen	Process Control Parameters; Fixture	
Function: Controls fixture angle settings, FlowCool™ helium flowrate, and defines the fixture rotation parameters during process steps.		**Fixture Angle** -70 to +90 degrees **FlowCool™ Flowrate** 0-100 sccm of helium **Fixture Rotation** **No Rotation** When selected, fixture will not rotate during the step. **Rotate Continuous** When selected, fixture rotates continuously during the step. **Sweep From: To:** Performs a continuous sweep of the fixture between two angles during the step. Enter from and to angles. **Static Angle** Fixture rotates to the indicated angle position and remains there for the step.

Process Create Screen	Magnetic Chuck
Function: The magnetic chuck controls the magnetic field through a dual-axis electromagnetic fixture. This option is not used with a standard fixture. The magnetic chuck selections are used when creating a recipe for a deposition source. A magnetic chuck consists of electromagnets inside the fixture that orients soft magnetic materials and defines easy magnetic direction during the deposition process. The electromagnet rotates with the fixture such that the magnetic field orientation with respect to the wafer, is fixed.	 **Use Magnetic Chuck** - when selected (for use with dual-axis electromagnetic fixture) enables the electromagnets to create a magnetic field in either the 0° or 90° direction during a deposition process. **Example** Dual axis alignment may be used in spin valves by using one direction for pinned layers and the other direction for the free layer.  **Substrate Layering Example**

Process Create Screen	Process Control Parameters; Target	
Function: Assigns target angle to specified process module during process. Target material assigned in the Configuration Screen.	 	**Don't Move Target** Wherever target is at the start of the step, it won't be moved from that position through that step. **Target Materials** The actual target materials are customer-defined. **Target Angle (optional)** Angle position of target. Home 40°, range 30° to 40°. First select the target by clicking on it and then enter the desired angle for the target to move to during the step that is being defined. **PM1 PM2 PM3** Selecting PM1 or PM2 will change the step screen to display the information for the selected module. PM3 is disabled.

Process Create Screen	**Process Control Parameters; Time and Process**

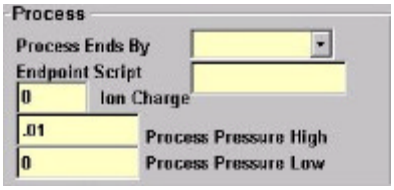
Function: Allows to user to define the process timing and how a step in a process will end.

Process Time

Use Electrostatic Shutter - When selected

Time - hours, minutes, seconds and milliseconds are used when Process Ends By time option is selected.

Use Etch Rate Correction # -



Process

Process Ends By - Drop down menu allows selection of time, ion charge, or endpoint to end the process step.

Time - Use this option to end the step after the total time specified has elapsed in the running of the process. Enter time in hours, minutes, seconds, and ms as shown above.

Ion - Use this option to end the step based on the value of the substrate's ion charge accumulation (in Coulombs). Enter Coulombs in the Ion Charge box.

Endpoint - Use this option to end the step by endpoint,. An optional endpoint computer is required and an endpoint script must be written and entered in the Endpoint Script box.

Process Pressure High - Upper process chamber pressure limit allowable during step. If pressure is higher, the process step aborts.

Process Pressure Low - Lower process chamber pressure limit that can be reached during step; any lower, the process step aborts.

Process Control Screen

CAUTION!

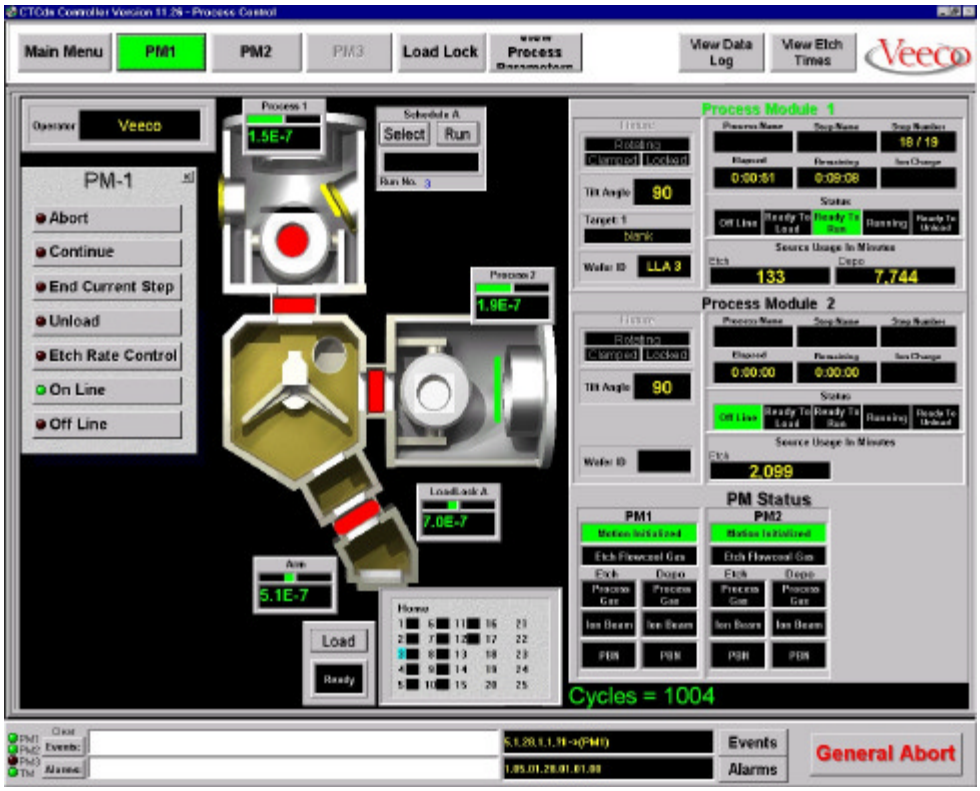
Failure to follow all safety instructions prior to using the system in the Unprotected mode (manual) can result in damage to the system and personal injury.

Use of the system in the Unprotected mode overrides all interlocks and precautions.

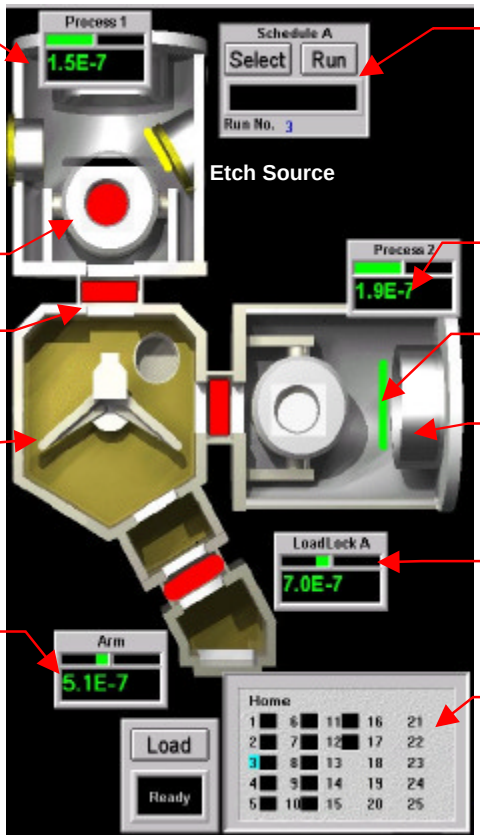
Any misuse of user privileges will result in warranty implications with dollar and time costs to the user and Veeco Instruments.

Function:

The Process Control screen controls the operation of the loadlock cassette elevator and robot arm, allows the user to select and run a process. Readbacks for the sources and wafer status are displayed along with the data log. The Process Control screen is displayed to all users. Access to sub-menus and operations depend on assigned privilege levels.



Understanding the Process Control Screen



Vacuum level readout for Process Module 1

Deposition Source

Fixture with Substrate

Isolation Valve

Arm Chamber and Robot Arm

Vacuum Level Readout for the Arm Chamber

Schedule Selection Box - Note identification of present run number.

Vacuum Level Readout for Process Module 2

Shutter

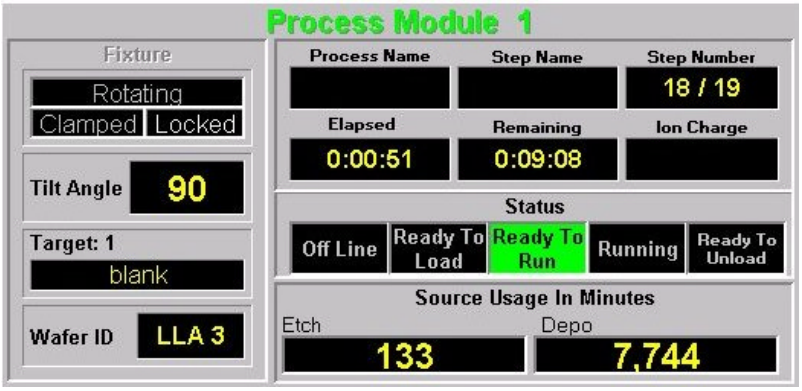
Etch Module Source

Vacuum Level Readout for Loadlock A

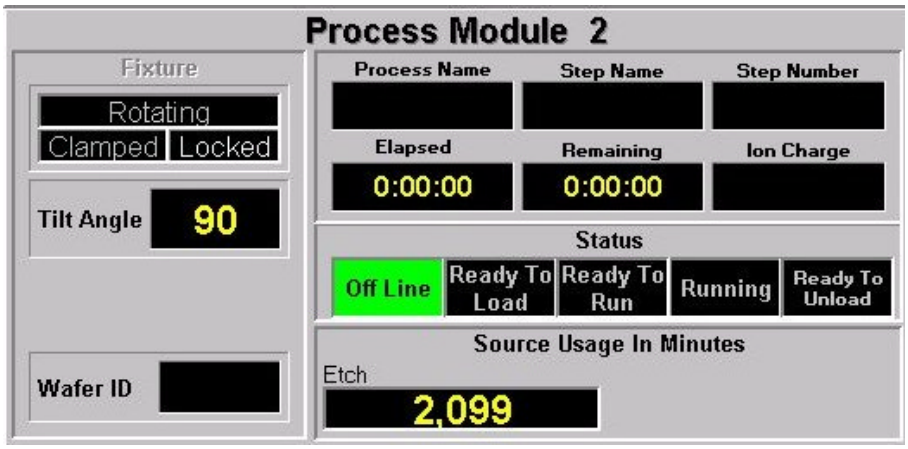
Substrate Number Identification. This example shows that substrate No. 3 is in process.

Substrate Status	**Red** = Unprocessed substrate in fixture **Green** = Processed substrate in fixture. **Gray** = Fixture is empty. **Yellow** = Substrate partially processed or currently being process in fixture.

Process Control Screen	**Understanding the Process Control Screen**	
Indicators During system operation the screen will display various operations, options, and processes. Their status is indicated when one of the colors to the right is lit next to the operation or function.	**Color**	**Status**
	Green	Green indicates the operation is currently being performed.
	Black	Black indicates the operation is not being performed.
	Red	Red indicates an error has occurred. If the substrate displays red, it means the substrate is unprocessed.
	Yellow	Yellow indicates a device is between two states or busy. If the substrate displays yellow, it means the substrate is partially processed.
	Gray	Gray indicates the option is disabled.
	Clear or **Blue**	Either color indicates that a valve is closed.

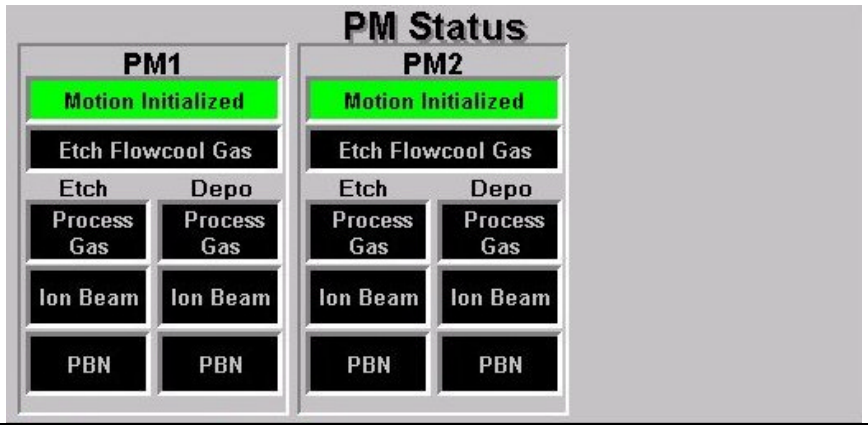
Process Control Screen	**Understanding the Process Control Screen**	
Function: The PM Status panel indicates the status of PM 1, the current process being run, the fixture position and status, and the target being used.		
Process	**Fixture**	When **green**, indicates the condition of the fixture. In the illustration above, the fixture is clamped and rotating. **Rotating** – the fixture is clamped in position and in continual rotating motion. **Clamped** – the clamps are down on the fixture. **Locked** – the fixture can not move. When the isolation valve opens, the fixture locks.
	Tilt Angle	The number indicates the angle position of the fixture. ♦ The range of the fixture is -70° to +90°. ♦ The home angle position is +90°.
	Target 1	Indicates the target in position and the target material. In this example, Ta (tantalum) is being used.
	Wafer ID	Displays the wafer ID number of the current wafer being processed. The wafer number is assigned by its position in the loadlock.
	Process Name	Displays the name of the currently running process or the name of the process that was just stopped.
	Step Name	Displays the name of the currently running step, or the name of the step that was being run when the process was stopped.
	Step Number	Displays the current step number of the total steps being run in the process.
	Elapsed	Displays the time elapsed since the start of the process.
	Remaining	Displays the time left to complete the process.
	Ion Charge	Displays the current ion charge.

Process Control Screen	**Understanding the Process Control Screen; PM1**	
Status	**Off Line**	A transfer cannot occur at this time.
	Ready To Load	A wafer is ready to be loaded. Motion is initialized and the vacuum levels are good.
	Ready To Run	A wafer is loaded and a process is ready to be run.
	Running	A process is currently running.
	Ready To Unload	The process is complete and the robot arm is ready to retrieve the wafer. Blue indicates the wafer is done and it is going to another process module, but that process module is not yet ready. It is in a holding state until the PM is ready and then the transfer will occur.
Source Usage (in minutes)	**Etch**	Readback of the time the etch source has been on (in minutes).
	Depo	Readback of the time the depo source has been on (in minutes).

Process Control Screen	**Understanding the Process Control Screen; PM2**	
Function: The PM Status panel indicates the status of PM 2, the current process being run, and the fixture position and status.		
Process	**Fixture**	When **green**, indicates the condition of the fixture. In the illustration above, the fixture is clamped and rotating. **Rotating** – the fixture is clamped in position and in continual rotating motion. **Clamped** – the clamps are down on the fixture. **Locked** – the fixture cannot move. When the isolation valve opens, the fixture locks.

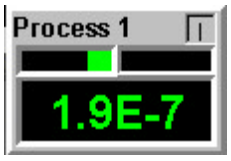
Process Control Screen	Understanding the Process Control Screen; PM2	
Process - Fixture	**Tilt Angle**	The number indicates the angle position of the fixture. ♦ The range of the fixture is -70° to +90°. ♦ The home angle position is +90°.
	Wafer ID	Displays the wafer ID number of the current wafer being processed. The wafer number is assigned by its position in the loadlock.
	Process Name	Displays the name of the currently running process or the name of the process that was just stopped.
	Step Name	Displays the name of the currently running step, or the name of the step that was being run when the process was stopped.
	Step Number	Displays the current step number of the total steps being run in the process.
	Elapsed	Displays the time elapsed since the start of the process.
	Remaining	Displays the time left to complete the step or process?
	Ion Charge	Displays the current ion charge.
Status	**Off Line**	A transfer cannot occur at this time.
	Ready To Load	A wafer is ready to be loaded. Motion is initialized and the vacuum levels are good.
	Ready To Run	A wafer is loaded and a process is ready to be run.
	Running	A process is currently running.
	Ready To Unload	The process is complete and the robot arm is ready to retrieve the wafer. Blue indicates the wafer is done and it is going to another process module, but that process module is not yet ready. It is in a holding state until the PM is ready and then the transfer will occur.
Source Usage (in minutes)	**Etch**	Readback of the time the etch source has been on (in minutes).

Process Control Screen	**Schedule A**
	Select Allows a previously written schedule to be selected and run. Refer to the Schedule section of this manual for instructions on writing a schedule. **Run** Runs the displayed schedule. In this illustration, CLEANTGT is the name of the current schedule

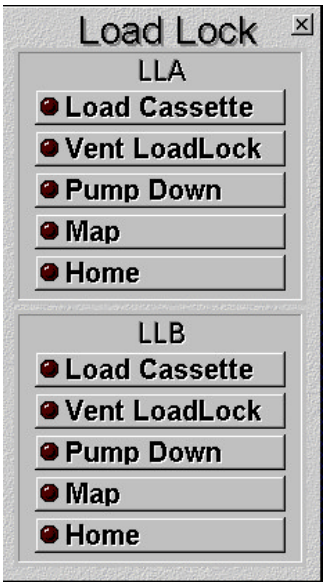
Process Control Screen	**PM Status**
Function: The PM Status panel indicates the current condition of the process modules, FlowCool™ gas, and the status of the sources. **Green** = good **Red** = error. **Yellow** = transitional	

PM STATUS	**WHEN GREEN, INDICATES...**
Motion Initialized	Motion Initialized means the fixture is in a state where it is safe for a substrate transfer to occur. When green, indicates that motion has been initialized and the following conditions exist: 1. Fixture tilted to the home position. 2. Fixture rotated to home position 3. FlowCoolTM gas supply and shutoff valves closed (if fixture is equipped with the FlowCool™ feature). 4. Fixture clamp is in the unclamped position.
Etch FlowCool™ Gas	Helium is flowing and cooling the fixture (if FlowCool™ is installed).
Etch Process Gas	Process gas is flowing within tolerance.
Ion Beam	Beam is on and is operating within specified tolerances.
PBN	PBN is on and is operating within specified tolerances.
Depo Process Gas	Process gas is flowing within tolerance. Does not apply to PM2 (etch module).

Process Control Screen	**Understanding the Process Control Screen**
PM STATUS	**WHEN GREEN, INDICATES...**
Motion Initialized	Motion Initialized means the fixture is in a state where it is safe for a substrate transfer to occur. When green, indicates that motion has been initialized and the following conditions exist: 1. Fixture tilted to the home position. 2. Fixture rotated to home position 3. FlowCool™ gas supply and shutoff valves closed (if fixture is equipped with the FlowCool™ feature). 4. Fixture clamp is in the unclamped position.
FlowCool™ Gas	Helium is flowing and cooling the fixture (if FlowCool™ is installed).
Process Gas	Process gas is flowing within tolerance.
Ion Beam	Beam is on and is operating within specified tolerances.
PBN	PBN is on and is operating within specified tolerances.
	Control Panels ***Schedule A*** **Select** Allows a previously written schedule to be selected and run. Refer to the Schedule section of this manual for instructions on writing a schedule. **Run** Runs the displayed schedule as defined through the Schedule screen. **Run No. X** Displays the run number presently being processed.
Loadlock 	***Load/Ready*** **Ready** ♦ If Ready is **yellow**, the loadlock chamber is either being pumped down or venting or the cassette is being mapped. ♦ If Ready is **green**, the loadlock chamber is pumped down, the cassette is mapped, and the loadlock chamber is ready to go. ♦ If Ready is **black**, the loadlock chamber is not ready as shown left. ♦ If Ready is **red**, an error has occurred. **Load** – performs the steps to move the substrate from the cassette into the selected process module.

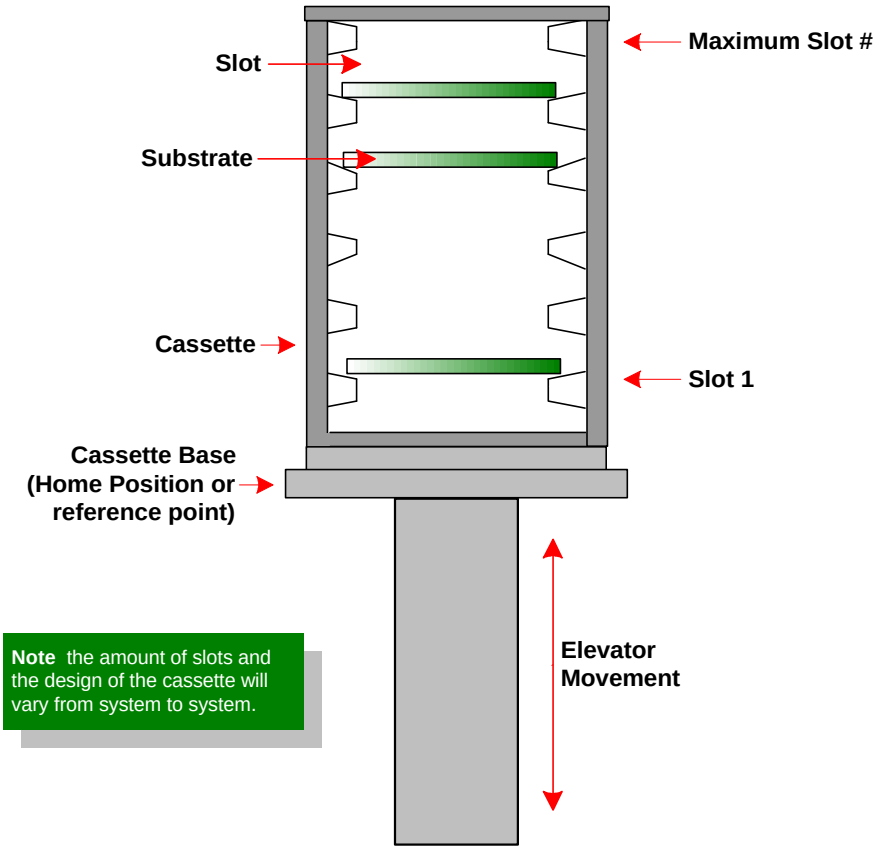
Process Control Screen	**Understanding the Process Control Screen**
	Vacuum Pressure Levels **Pressure** For the process module(s), loadlock chamber, or arm chamber: Either an **ion gauge** (measuring atmosphere to rough vacuum level, 1 x 10^{-2} Torr) ***or*** a **Pirani gauge** (measuring rough to hi vacuum, 1 x 10^{-2} Torr to 1 x 10^{-9} Torr) will be displayed depending on the current vacuum level.  The trend bars over the readback indicate the amount of pressure change over time. **Green** indicates the pressure is decreasing, **red** indicates the pressure is increasing.

Process Control Screen	**PM-1 or -2 Control**
 LED indicates current condition of process module. This example shows the panel for PM 1. The panel for other process modules identical.	**Abort** When Abort is selected the following conditions occur: 1. Current process being run stops. 2. Timer (internal clock stops counting). 3. Beam turns off. 4. Process gas turns off. 5. FlowCool™ turns off (if installed). This step is defined in the .ini file and is factory set. 6. The system goes off line. **Continue** Resumes running an aborted process from the step where it was aborted. **End Current Step** Sets time of current step to stop (if running *end by time* option). **On Line** When the process module is on line (**green** status indicator) a wafer can be loaded and unloaded, automatic transfers can occur and processes can be run. **Off Line** When the process module is off line, (**green** status indicator), *automatic* processes and transfers cannot occur. However, automatic processes and transfer may be performed *manually*. The process module is placed off line at the Process Module Screen. • **Green = on** • **Black = off**

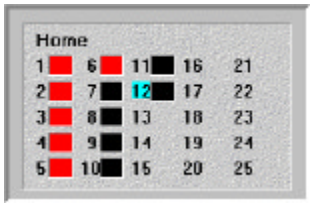
Process Control Screen	**Loadlock Vacuum Sub-Menu**	
Function: Allows selection of automatic processes to be run. • **Green = on** ● **Black = off**		**Load Cassette** An automatic function that pumps down the loadlock chamber, maps the cassette, and prepares the loadlock for a schedule to process wafers. **Vent Loadlock** An automatic procedure that vents the loadlock chamber by closing what valves and applying nitrogen to the chamber. When the venting is complete the LED indicator lights? **Map** Refer to *How to Map the Cassette*, on the next page. **Home** Brings the elevator to its home position or reference point. All other positions are determined by referring to the home position.

Process Control Screen	How to Map the Cassette
  Before mapping note that **all** substrates in the cassette must be the same diameter and thickness. Otherwise, the pitch will be off and the mapping will not occur correctly. ***Notes**:* *When the cassette is mapping, Busy is displayed.* *Unprocessed substrates display in red.*	**Function:** An automatic sequence maps the cassette, and prepares the loadlock for a schedule to process wafers. Mapping assigns the status of unprocessed to all substrates in the cassette. The cassette must be mapped and pumped down in order for the schedule to process a substrate. **When to Map.** Map the cassette after a new batch of substrates is loaded onto the rack and the rack has been loaded into the chamber and the chamber door is closed. **How to Map.** You can map the cassette by selecting **Load**, and a prompt Map Y/N will display or by selecting **Map** from the Loadlock sub-menu. **Time to Map** It takes approximately one minute for the cassette to map. After a successful mapping, the Event box will display a message and a corresponding code. **Map** The part of the automatic sequence that does the mapping causes the following to occur: 1. Elevator goes to the home position. 2. Elevator goes to the slot defined as 1. *3.* The software erases all previous substrate status and records all the substrates as unprocessed. The *Substrate Status Screen* displays the new status. 4. The software cycles through all slots (maximum 25) and repeats steps 1-3 for all substrates detected. **Load** Performs the steps to move the substrate from the cassette into the selected process module. **Ready** ♦ If Ready is yellow, the loadlock chamber is either being pumped down or venting or the cassette is being mapped. ♦ If Ready is green, the loadlock chamber is pumped down, the cassette is mapped, and the loadlock chamber is ready to go as shown left. ♦ If Ready is black, the loadlock chamber is not ready. ♦ If Ready is red, an error has occurred.

Process Control Screen	***Cassette Illustration***



Note the amount of slots and the design of the cassette will vary from system to system.



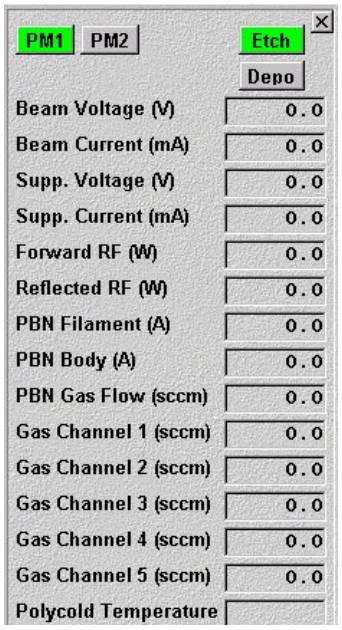
Cassette Substrate Status

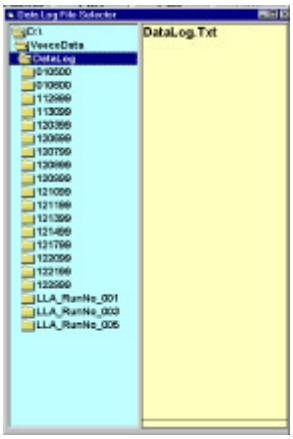
This section of the Process Control Screen illustrates the number of slots in the cassette. Maximum of 25.

Red = Wafer in slot unprocessed.
Green = Wafer in slot processed.
Yellow = Wafer in slot partially processed.
Black = No wafer in that slot.

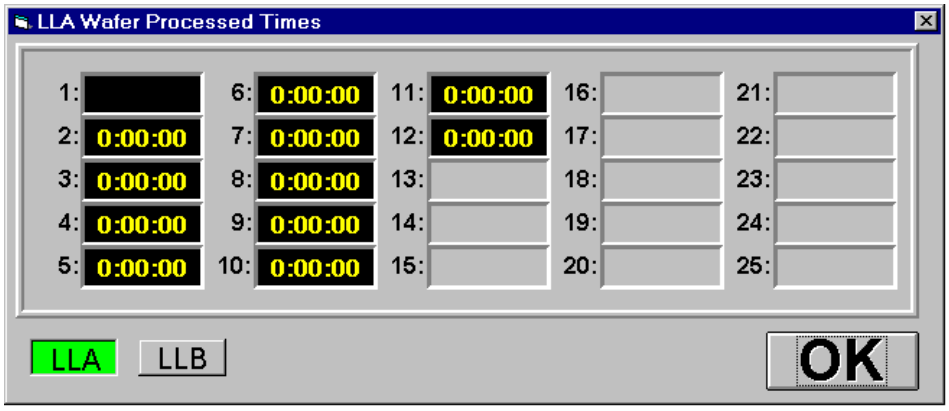
When a slot number is highlighted in blue, it indicates that the arm is ready to pick up a substrate from that position. The highlighted slot position is aligned with the opening of the isolation valve.

If Home is highlighted, the elevator is all the way up and not aligned to load or unload any substrate.

Process Control Screen	**View Process Parameters**
Function: Displays the real-time parameters of the currently running process. Select the process module (PM1 or PM2), then select the desired source.	

Process Control Screen	**View Data Log**
	**Function:** Displays the file locations of data logs. Click on the desired log and it will display. To close and return to the program, click on the **X**. Each day a new sub-directory is created with the current date. In that sub-directory will be the RunNoXXX sub-directory of the day. Each time another cassette is run the RunNo is incremented. In each Run No sub-directory will be the Waferxx file, there will be a file for each cassette that was processed. Run numbers indicate either LLA or LLB, with file named LLA-RunNoXXX The log file name contains the date the log was created. *For example if the file name is:* **062398.txt** 06 = month 23 = day 98 = year 2000 will print 00.

Process Control Screen	**View Etch Times**
	Function: Sums up total process time per wafer. Used only with processes that end by endpoint.



Sample View Etch Times Screen for Loadlock A

Process Module Screen

The Process Module Screen is intended for users with a privilege level of Process Engineer or above.

Caution!

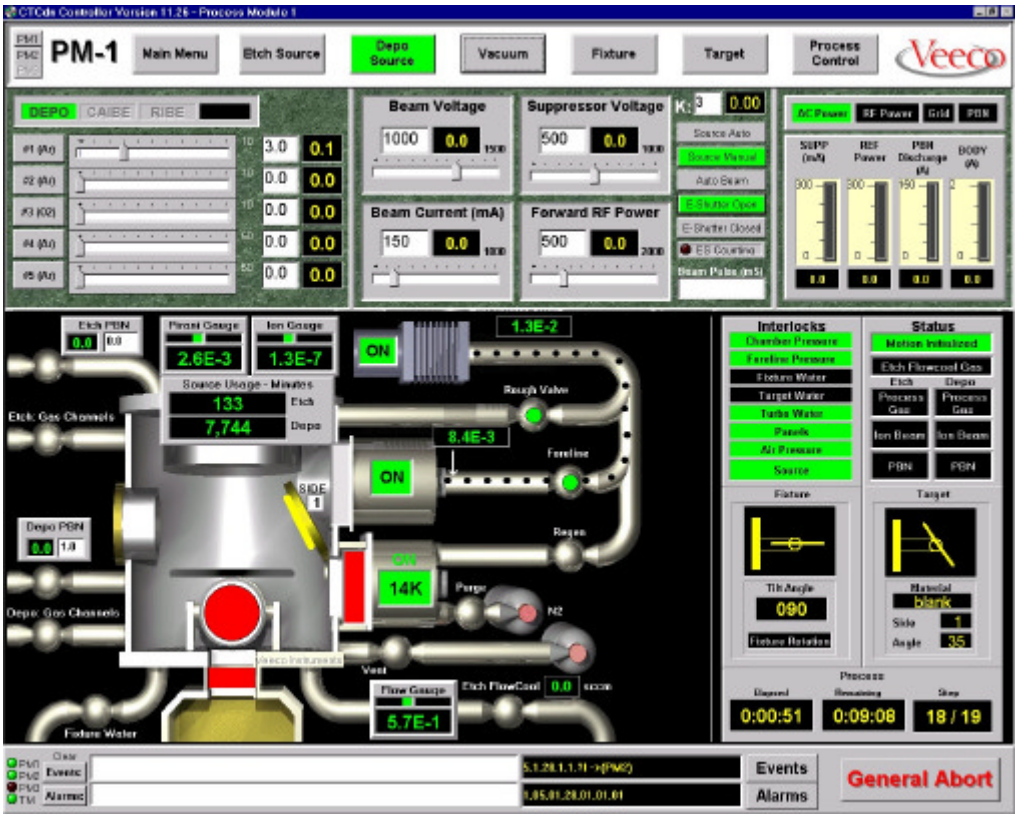
Failure to follow all safety instructions prior to using the system in the Unprotected mode or manual mode can result in damage to the system and personal injury.

Use of the system in the Unprotected mode overrides <u>all</u> interlocks and precautions.

Any misuse of user privileges may result in warranty implications with dollar and time costs to the user and Veeco Instruments.

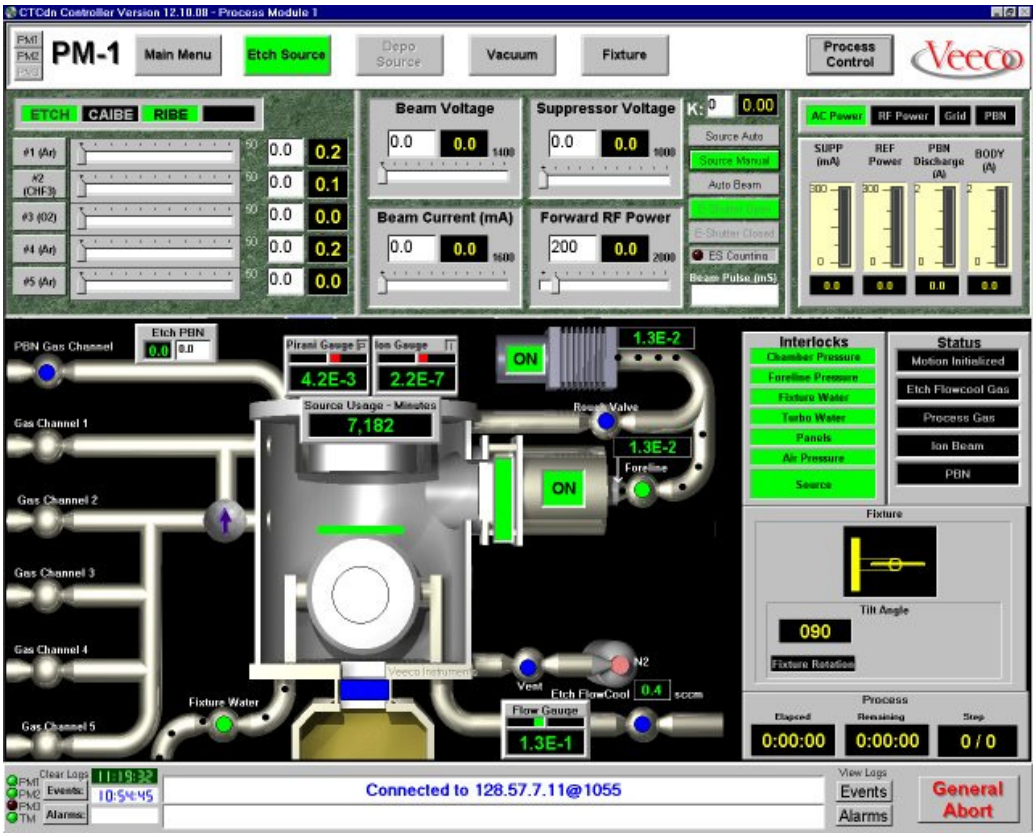
Function:

From this Process Module screen, the user may control major functions and view the real-time status of various areas in either module. If a process is currently running, the process parameters currently being applied can be viewed. Selection of either depo or etch source parameters can be displayed. This screen is also routinely used when performing PM (preventive maintenance) procedures. Shown below is the Process Module screen for PM1, which is a deposition module.



Process Module Screen for PM1 with Depo Source Status Shown

Process Module Screen	**Process Module Screen; Etch Module**



Process Module Screen for PM2 (etch) with Source Status Shown

Process Module Screen	**Before You Proceed**

Caution!

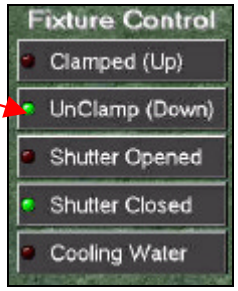
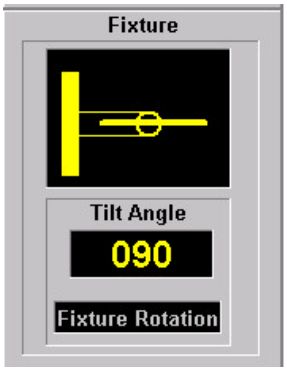
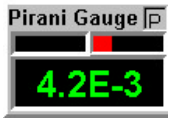
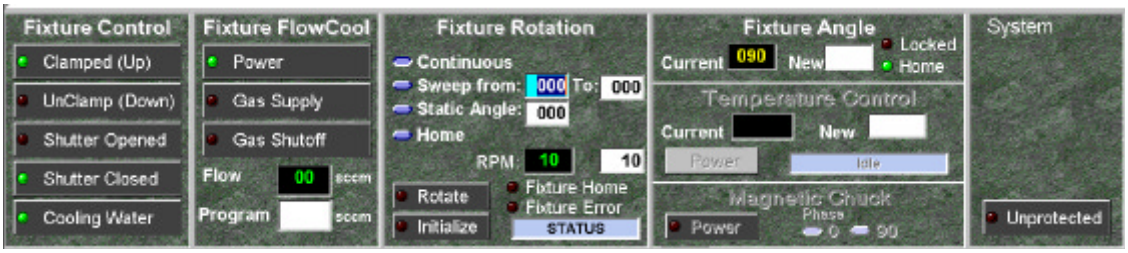
When the system is operated in the Unprotected mode, extreme caution must be exercised since all built-in safety features and interlocks are disabled.

Changing screens clears the unprotected mode and restores all safety features and interlocks.

If indicator is red, the system is being operated in the Unprotected mode. This mode is only for use by trained personnel with privilege levels of System Supervisor or higher.

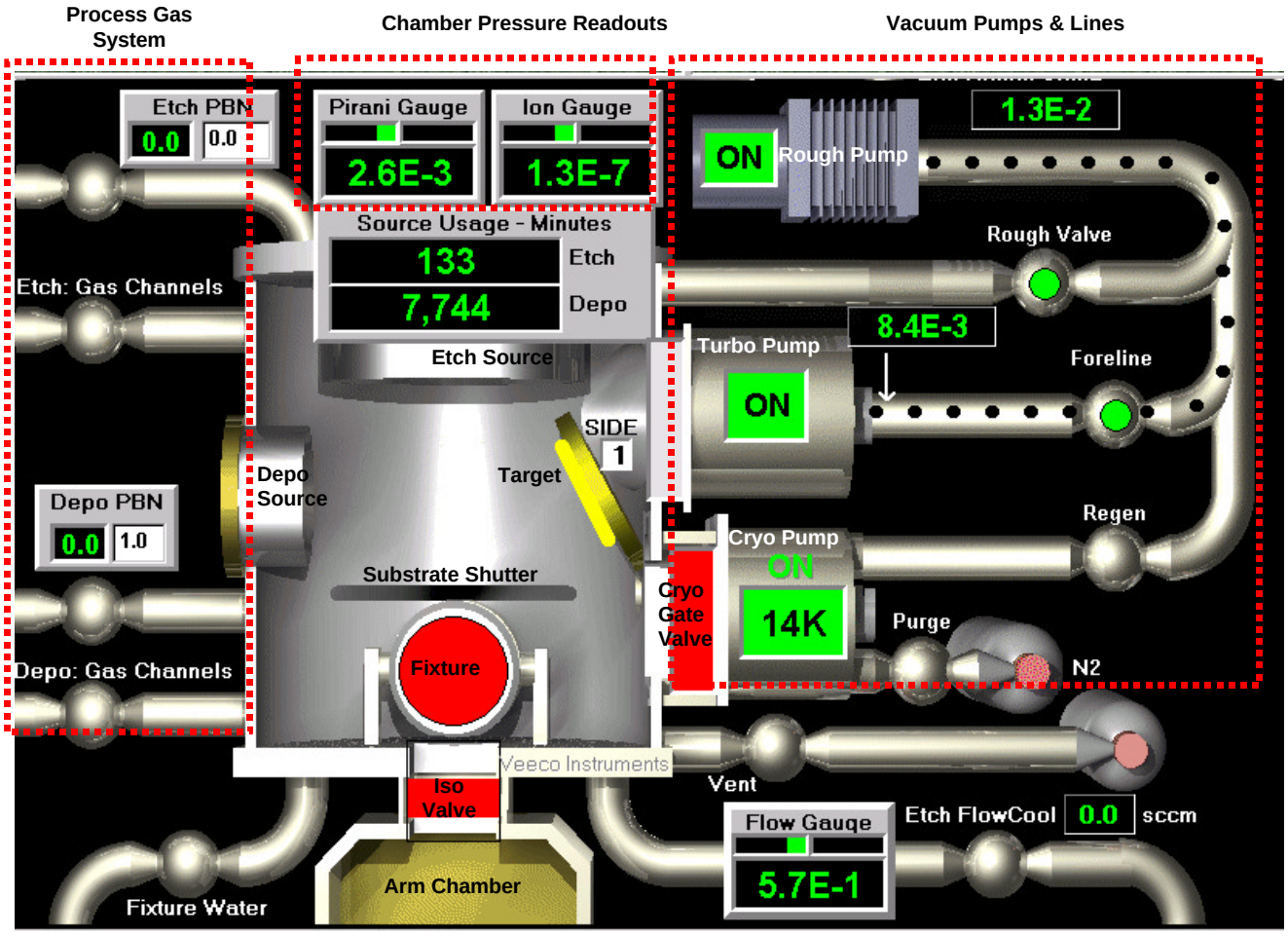
Process Module Screen	**Understanding the Process Module Screen**

The Process Module screen provides the user with real-time system information and allows the user to change some of the system's parameters. As a result of the system's complexity, the Process Module screen is very intricate. To simplify this screen, it is easiest to separate it into distinct categories. The categories and their functions are listed in the following table.

Category	Function	General Appearance
Buttons Bar	Access a Control Panel or the Main Menu. This portion of the screen is static.	 *In this example the Depo Source control panel in Process Module 1 is selected. Options are Main Menu, Etch Source, Depo Source, Vacuum, Fixture, Target, and Process Control.*
Indicators	Display various operations, options, and processes indicated by color. A green indicator shows the function as being active, black inactive, and red indicates an error.	**Green indicator**  In this example, the fixture's status is indicated by green lights.
Status Panels & Readouts	Display the condition of a given area in the system.	 In this example, the fixture's status is displayed on this status panel. Below is a sample readout. 
Control Panels	Allows for more precise control of a specific area in the system. The actual panel displayed depends on the selection made on the Button Bar.	 This control panel will display when then user clicks on the Fixture button on the Button Bar.

Understanding the Process Module Screen

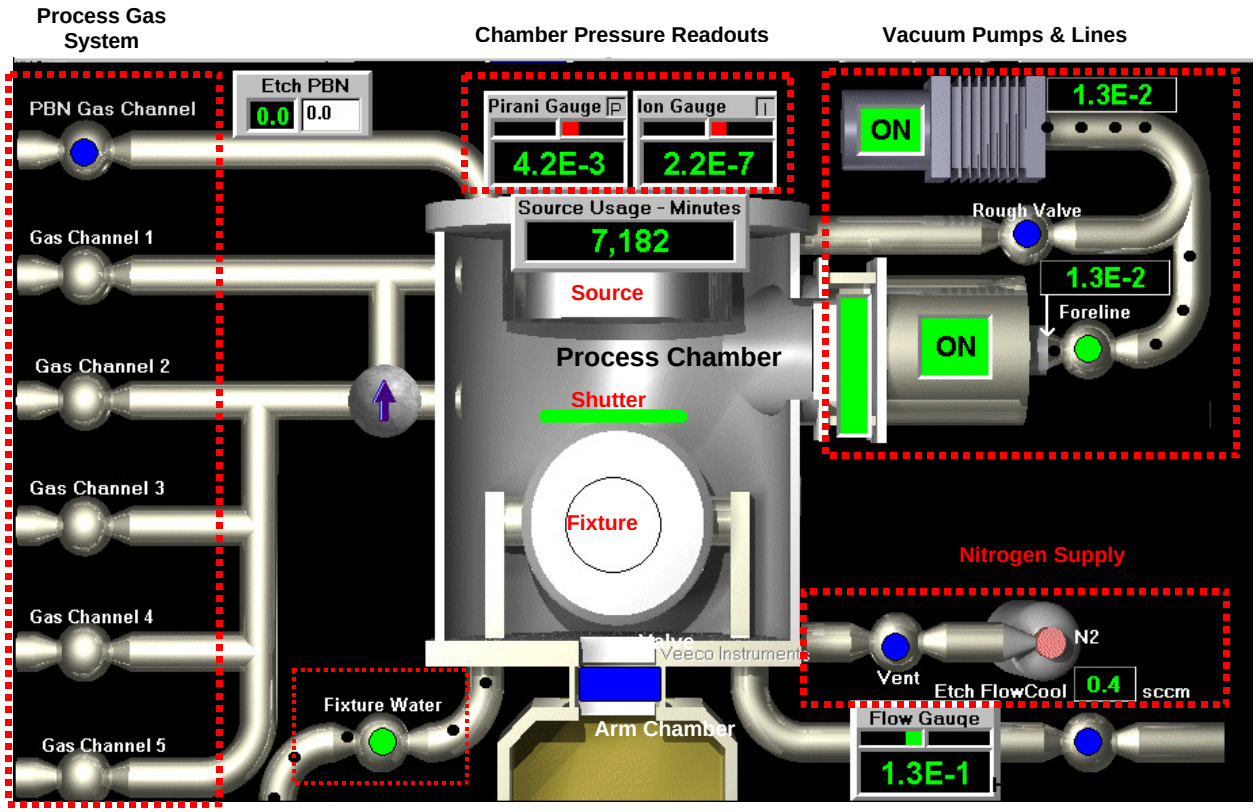
Deposition Module



This is an example of the deposition Process Module screen depicting the process chamber and its primary subsystems and components.

Understanding the Process Module Screen

Etch Module

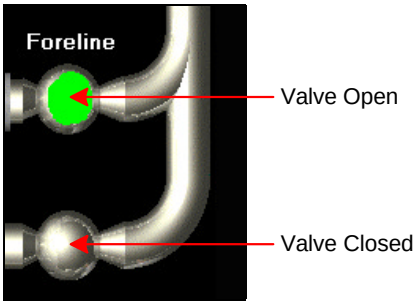


This is an example of the etch Process Module screen depicting the process chamber and its primary subsystems and components.

<table>
<tr><td>Process Module Screen</td><td colspan="3">Indicators</td></tr>
<tr><td rowspan="5">During system operation the screen will display various operations, options, and processes.

Their status is indicated when one of the colors to the right is lit next to the operation or function.

For example, the status of the substrate is unclamped, the shutter is closed, and cooling water is not flowing.</td><td>COLOR</td><td colspan="2">STATUS</td></tr>
<tr><td>• Green</td><td colspan="2">Green indicates the operation is currently being performed. Green also indicates valves are open, power supplies are on, and vacuum pumps are on.</td></tr>
<tr><td>• Black</td><td colspan="2">Black indicates the operation is not being performed. Black also indicates when power supplies and pumps are off.</td></tr>
<tr><td>• Red</td><td colspan="2">Red indicates an error has occurred. For an isolation valve, red indicates the valve is closed.

If the substrate displays red, it means the substrate is unprocessed.</td></tr>
<tr><td>• Yellow</td><td colspan="2">Yellow indicates a device is between two states or busy. For example, the robot arm is moving, turbo is not up to speed, isolation valves moving, or the shutter moving. If the substrate displays yellow, it means the substrate is partially processed.</td></tr>
<tr><td>For valves, open is indicated in green, and closed valves are as shown as clear or blue.</td><td>• Gray</td><td colspan="2">Gray indicates the option is disabled.</td></tr>
<tr><td>For valves, open is indicated in green, and closed valves are as shown as clear or blue.</td><td colspan="2"> 
</td><td>

Rough valve closed</td></tr>
</table>

Process Module Screen	**Status Panels and Readouts**

Interlocks Panel; PM1 (Depo)

Interlocks Panel - Depo Module

Function:

Each module is equipped with software and hardware interlocks for equipment and personnel safety. During a process, before a beam will go on, all the interlocks must be made; that is, their conditions satisfied as defined in the next table.

The interlock lights green when made, black when not made. The interlock panel to the right shows all interlocks are made.

Green = good

Red = error

Yellow = transitional

	Conditions Required For Making Interlock
Chamber Pressure	The process chamber is pumped to the vacuum pressure setpoint level as programmed into the chamber's Pirani controller and as defined in the Configuration screen.
Foreline Pressure	The pressure in the foreline (between the rough pump and the turbo) is at the preprogrammed vacuum level.
Fixture Water	When the fixture water interlock is green, it indicates water is flowing through the fixture at the proper rate (30 gph). If a chiller is installed, chiller water must flow at 0.8 gpm. The Process Module screen indicates fixture water flow with moving dots.
Target Water	When green indicates house water is flowing around the target and sources. Does not apply to the etch module.
Turbo Water	The turbo pump is on and house water is running through the turbo at the appropriate rate (30 gal/hr)
Panels	All control rack panel doors, chamber doors, and the PBN cover are closed.
Air Pressure	The air pressure at all valves must be 80-90 psi.
Source	The source power supply water flow must be at 1 gpm, and the source water must be at 0.67 gpm. The source RF shields must be closed. All other interlocks must be made for the source interlock to be made. When made, the source can then be turned on for testing or to run a process.

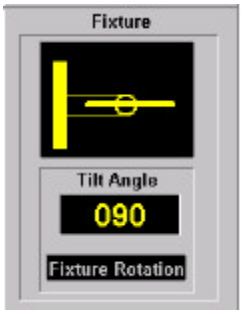
Process Module Screen	**Status Panels and Readouts**
Interlocks Panel; PM2 (Etch)	
	Function: During an etch process, before the beam will go on, all the interlocks must be made; that is, their conditions satisfied as defined in the next table. The interlock lights green when made, black when not made. The interlock panel to the right shows all interlocks are made.
	Conditions Required For Making Interlock
Chamber Pressure	The process chamber is pumped to the vacuum pressure setpoint level as programmed into the chamber's Pirani controller and as defined in the Configuration screen.
Foreline Pressure	The pressure in the foreline (between the rough pump and the turbo) is at the preprogrammed vacuum level.
Fixture Water	When the fixture water interlock is green, it indicates water is flowing through the fixture at the proper rate (30 gph). If a chiller is installed, chiller water must flow at 0.8 gpm. The Process Module screen indicates fixture water flow with moving dots.
Turbo Water	The turbo pump is on and house water is running through the turbo at the appropriate rate (30 gal/hr)
Panels	All control rack panel doors, chamber doors, and the PBN cover are closed.
Air Pressure	The air pressure at all valves must be 80-90 psi.
Source	The source power supply water flow must be at 1 gpm, and the source water must be at 0.67 gpm. The source RF shields must be closed. All other interlocks must be made for the source interlock to be made. When made, the source can then be turned on for testing or to run a process.

Process Module Screen	**Status Panels and Readouts**
Process Module Status Panel; PM1	
 The status lights turn green when the condition is present as defined in the next table.	**Function:** The PM Status panel indicates the status of the depo module's fixture, and process gas, source beam, and PBN for both the etch and depo sources. **Green** = good **Red** = error. **Yellow** = transitional
	When Green, Indicates the Following:
Motion Initialized	Motion Initialized means the fixture is in a state where it is safe for a substrate transfer to occur. When green, indicates that motion has been initialized and the following conditions exist: 1. Fixture tilted to the home position. 2. Fixture rotated to home position 3. FlowCool™ gas supply and shutoff valves closed (if fixture is equipped with the FlowCool™ feature). *4.* Fixture clamp is in the unclamped position.
Etch FlowCool™ Gas	Helium is flowing and cooling the fixture (if FlowCool™ is installed).
Etch Process Gas	Process gas is flowing within tolerance.
Ion Beam	Beam is on and is operating within specified tolerances.
PBN	PBN is on and is operating within specified tolerances.
Depo Process Gas	Process gas is flowing within tolerance. Does not apply to PM2 (etch module).

Process Module Screen	**Status Panels and Readouts**
Process Module Status Panel; PM2	
 The status lights turn green when the condition is present as defined in the next table.	**Function:** The PM Status panel indicates the etch module's current status for the fixture, process gas the source and the PBN. **Green** = good **Red** = error. **Yellow** = transitional
	When Green, Indicates the Following:
Motion Initialized	Motion Initialized means the fixture is in a state where it is safe for a substrate transfer to occur. When green, indicates that motion has been initialized and the following conditions exist: 5. Fixture tilted to the home position. 6. Fixture rotated to home position 7. FlowCool™ gas supply and shutoff valves closed (if fixture is equipped with the FlowCool™ feature). *8.* Fixture clamp is in the unclamped position.
Etch FlowCool™ Gas	Helium is flowing and cooling the fixture (if FlowCool™ is installed).
Etch Process Gas	Process gas is flowing within tolerance.
Ion Beam	Beam is on and is operating within specified tolerances.
PBN	PBN is on and is operating within specified tolerances.

Process Module Screen	**Status Panels and Readouts**

Fixture Angle Status Panel



90° position.

Function:

Displays the current fixture's angle.

Tilt Angle Range +90° to -70°

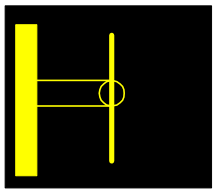
Home = 90°

Green = rotating

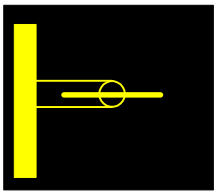
Black = not rotating

Red = error

To enter a new fixture angle, access the Fixture panel and type in the desired value in the "New" field.



Above. Fixture in the 0° position.



Above. Fixture in the 90° position.

Target Angle Status Panel

Function:

This panel applies only to the IBD module. If the target tilt feature is installed, this panel displays the current target angle. To enter a new target angle, access the Target sub-menu in the Process Module screen.

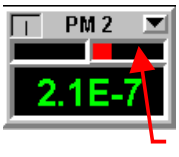
Tilt Angle Range 30° to 40°

Home = 40°

The target's material and side are displayed along with their respective labels.

Process Module Screen	**Status Panels and Readouts**

Chamber Vacuum Pressure Readouts



Trend Bar

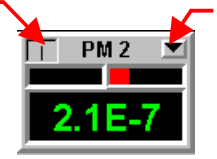
The trend bars over the readback indicate the amount of pressure change over time.

Green indicates the pressure is decreasing, **red** indicates the pressure is increasing.

Chamber Pressure Readouts

The ion gauge readout displays pressure from atmosphere to rough vacuum level (optional). The Pirani gauge readout displays the pressure from rough to high vacuum.

Pressure measured by the **I**on gauge. A Pirani gauge readout is indicated by a **P**.

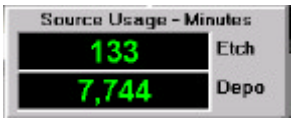


Click here to access dropdown menu containing other chamber readouts.

Pirani gauge readout

Ion gauge readout

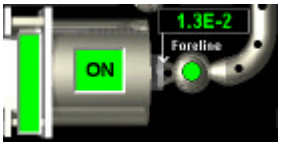
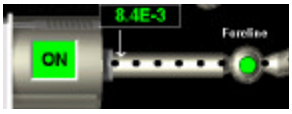
Source Usage Readout



Readout of the time each source beam has been on (in minutes). In this example, the etch beam has been on for 133 minutes. The depo beam has been on for 7,744 minutes. To clear a clock, access the Configuration screen.

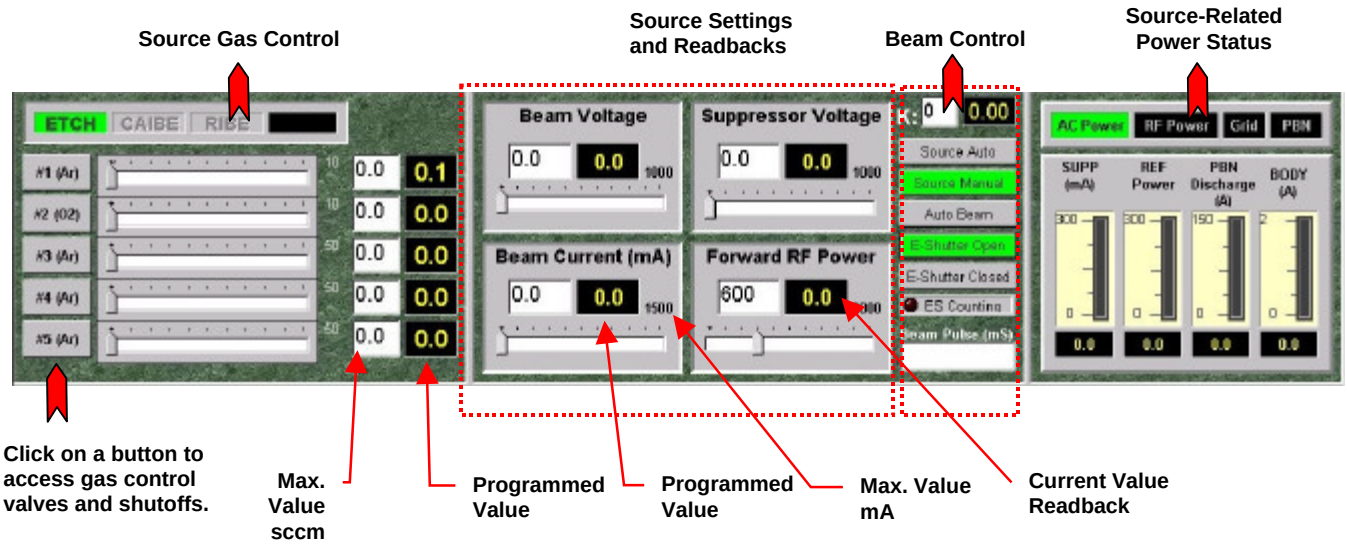
PBN Gas Pressure Readout

Readout of the PBN's gas pressure. Normal range is 10-20 psi.

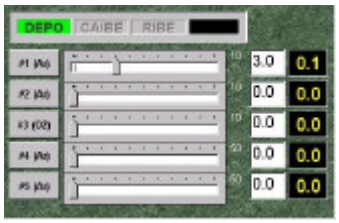
Process Module Screen	Status Panels and Readouts
Helium Flow and Pressure Readout	
	Readout of the FlowCool™ helium flow and pressure.
Foreline Pressure Readout	
 Etch Module  Depo Module	Readout of the current pressure in the foreline.
Rough Line Pressure Readout	
 Etch Module Depo Module	Readout of the pressure in the rough line.

Source Control

This example illustrates how the source's control panel may look in the etch module. In this panel, a user may view gas flow settings by channel, source-related readbacks, current values for AC power, RF, Grid, and PBN power. The user may change the values in this control panel. Manual beam control is also provided.



Source Gas Control



Sample Depo Source Gas Control Panel

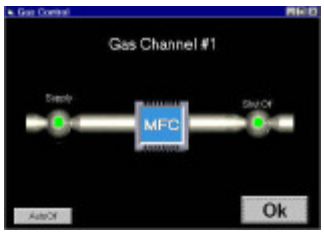
ETCH indicates gas status for the etch source.

DEPO indicates gas status for the depo source.

RIBE (***Reactive Ion Beam Etching***) - *Used only on etch modules*. When green, indicates reactive gas channel is diverted into the source for processing.

CAIBE (***Chemically Assisted Ion Beam Etching***) - Used only on etch modules. When green, indicates reactive gas channel is diverted into the chamber or CAIBE ring to assist ion beam.

Channels 1-5 Supply - Displays the five gas channels, the gas used in each channel and gas flow levels.



Turning on the Gas Channels

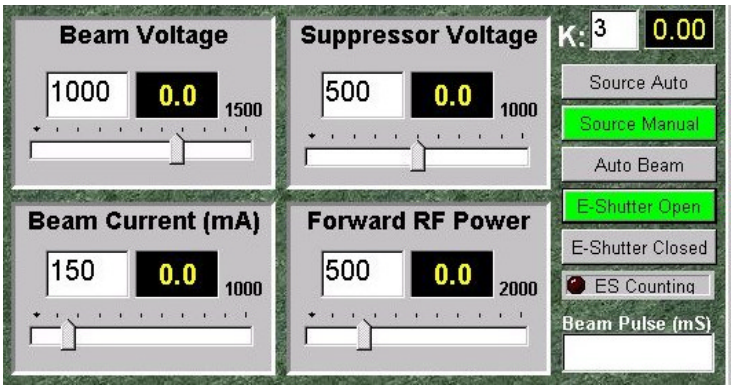
The shutoff valve is turned on first, the supply valve is turned on afterward.

The valve displayed on the screen turns green when open as shown in the example to the left.

Auto Off turns off the valves automatically by performing the following:

1. Turns off supply valve.
2. Waits 6 seconds.
3. Turns off shutoff valve.
4. Pumps out in-line gas.

Process Module Screen	**Control Panels**



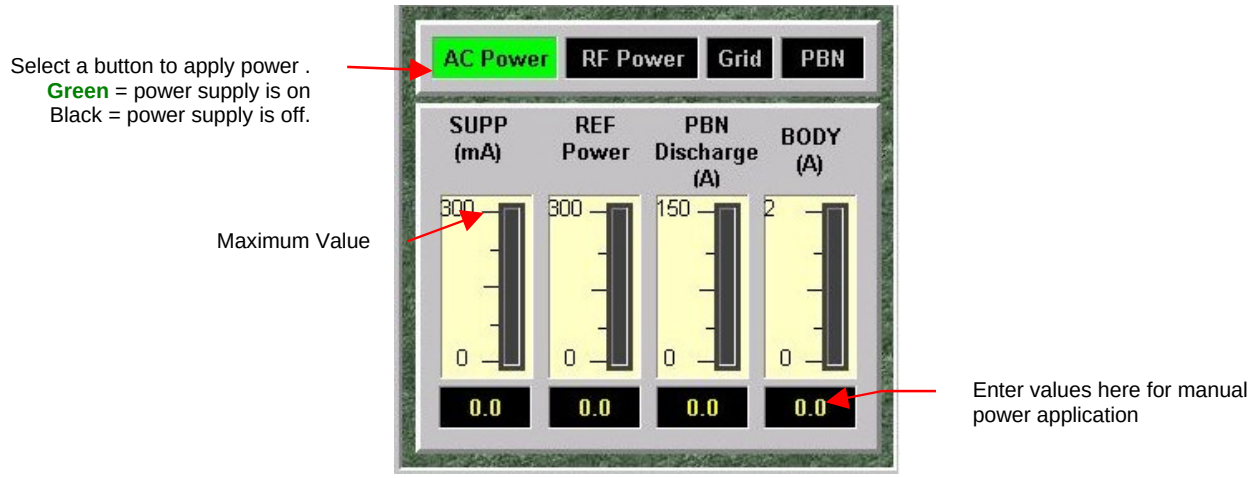
This example shows the source readbacks and controls for the deposition source in the depo module. Here the manual source mode is enabled and the electrostatic shutter is open.

Source Power and Operation Controls

Beam Voltage (V)	Real-time level of beam voltage applied to the grids. Enter the numeric values by positioning the cursor and typing the number to set value.
Beam Current (mA).	Real-time level of beam grid current. Enter the numeric values by positioning the cursor and typing the number to set value.
Suppressor Voltage (V)	Real-time level of suppressor grid voltage. Enter the numeric values by positioning the cursor and typing the number to set value.
Forward RF Power	Current total power output of the RF power supply. Enter the numeric values by positioning the cursor and typing the number to set value.
K	Ratio of PBN current to beam current; should be >1. $K = I_{PBN} / I_{BEAM}$
Source Auto	Indicates the selected source operates on values set by the computer and is under computer control.
Source Manual	Indicates the selected source operates under user control. The user sets the sources levels on values selected manually at the power supplies in the rack by the user.
Auto Beam	All functions (grids, gas, RF power) are turned on by the computer when a process is run. Or, these values can be entered manually on the screen above and then select Auto Beam.
E-Shutter Open	The beam is on.
E-Shutter Closed	The beam is off.
ES Counting	Used only if electrostatic timer board is installed. When indicator is green, the timer board is in the process of a countdown.
Beam Pulse (mS)	The beam on-time in milliseconds, displays when in manual mode.

Process Module Screen	**Control Panels - Source**
Applying Power to the Source	
Source Auto	When selecting auto beam from the Automatic Functions panel, the following automatic sequence occurs: 1. AC power is applied. 2. Turn the RF power on and brings it up to the programmed level. 3. Ramps up PBN voltage to the preset value and opens MFC supply valve for the PBN gas. 4. Turns on the beam and suppressor grid power supplies. 5. Turns the gas to the sources on. 6. Plasma is ignited and the beam is on.
Manual	**To turn the power supplies on manually, perform the following:** 1. Enter all the values for the power supplies on the screen on the previous page. **Note: the power supplies must be turned on <u>in the proper sequence</u> as follows:** 2. Turn the suppressor power supply on. 3. Turn the RF power supply on. 4. Turn the PBN power supply on. 5. Turn the grid power supply on. 6. Turn the gas on manually.

Process Module Screen	**Control Panels**



Source Power Supply and AC Controls

AC Power	Turns on the power to the power supplies in both racks if chamber vacuum interlock switch is made.
RF Power	Turns on RF power generator.
Grid	Turn on power supplies for the grid (suppressor and beam supplies in the rack) and, if voltage values are present, applies these voltage values to the grids.
PBN	Applies power to the PBN.
SUPP (mA)	The amount of current, in mA, at the suppressor grid.
REF Power	Power reflected back from the source to the RF generator output due to an impedance mismatch. The automatic networking software automatically controls any mismatches.
PBN Discharge (A)	The amount of discharge current, in Amps, at the PBN.
Body (A)	Readback from the PBN body power supply. The amount of current, in amps, found at the PBN body.

Process Module Screen	**Control Panels**

Vacuum Control

LED INDICATORS

Green - indicates that the function is on and that valves are open.

Black - (the LED is off) indicates the operation is not being performed. Black also indicates when power supplies and pumps are off.

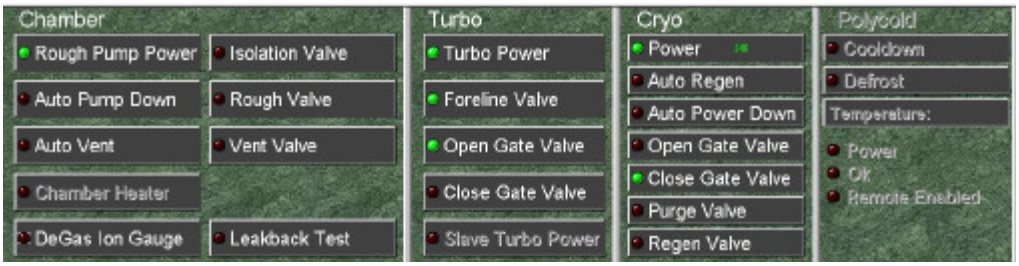
Red - indicates an error occurred.

Yellow – indicates motion.

Gray - option not available.

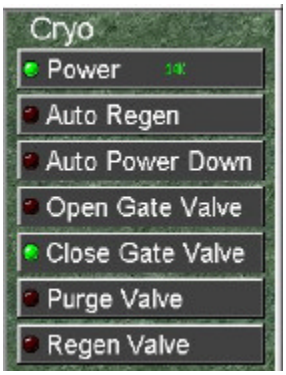
Function:

The Vacuum Control panel controls the process chamber's pumps, valves, and the degas ion gauge and PolyCold™ unit (if installed). It also displays the power status of the pumps and the cryo temperature. Each pump, valve, or operation is a button with an LED indicator.



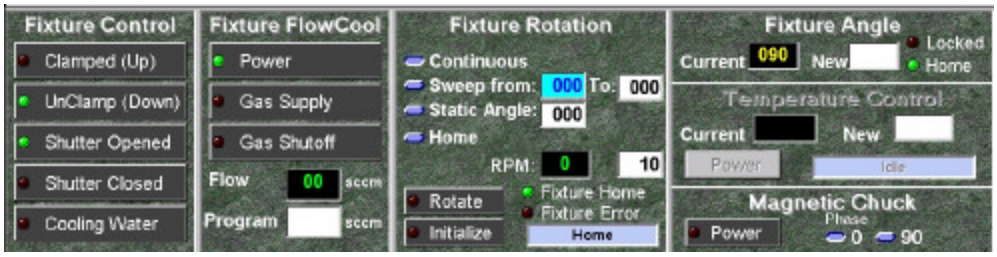
Rough Pump and Valve Controls

Rough Pump Power	Toggles power to the rough pump on and off.
Auto Pump Down	When activated, automatically pumps down the process chamber.
Auto Vent	Performs an auto-vent of the process chamber.
Chamber Heater	If chamber heaters are installed, this button toggles the power on and off. In this example, chamber heaters are not available.
Degas Ion Gauge	If an ion gauge is installed on the chamber, enabling this option will degas it.
Rough Valve	Opens and closes the process chamber's rough valve.
Isolation Valve	Opens and closes the gate (isolation) valve between the selected process module and the arm chamber.
Vent Valve	Open and closes the process chamber's vent valve.
Leakback Test	A leakback test, which is used routinely after maintenance, is performed automatically by pressing this button.

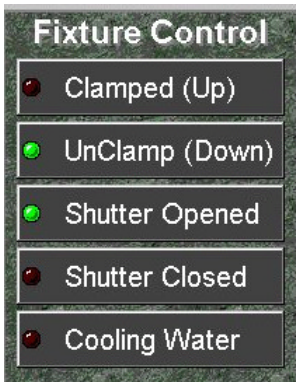
Process Module Screen	Control Panels	
Turbo Pump Controls		
	Turbo Power	Turns the turbo pump on and off. Green the main turbo pump is on and up to speed, when the LED is yellow it indicates the turbo is spinning up.
	Foreline Valve	Opens and closes the foreline valve. Green indicates the foreline valve is open, yellow it is closed.
	Open Gate Valve	Green indicates the turbo gate valve is open.
	Close Gate Valve	Green indicates the turbo gate valve is closed.
	Slave Turbo Power	Turns the slave turbo (drag) pump (backup pump to the main turbo*)* on and off. Green indicates the slave turbo is on, while yellow indicates it is spinning up. In this example, the button is grayed out, indicating that there is no slave turbo pump.
Cryo Pump Controls		
	**Power**	Turns the cryo cold head on and off. The green lettering indicates the temperature of the cryo cold head.
	Auto Regen	When selected, causes the cryo pump to perform an automatic regeneration (purge and cool down).
	Auto Power Down	Performs an automatic power down of the cryo pump. When the LED is green, the auto power down sequence is in process.
	Open Gate Valve	Opens the cryo gate valve (if installed). Green LED indicates the cryo gate valve is open.
	Close Gate Valve	Closes the cryo gate valve (if installed). Green LED indicates the cryo gate valve is closed.
	Purge Valve	Opens and closes the cryo pump's purge valve. Green indicates the purge valve is open, black indicates it is closed.
	Regen Valve	Opens and closes the regen valve. Green indicates the regen valve is open, black indicates it is closed.
PolycoldÔ Pump Control		
PolyCold Power	This option applies power to the PolyCold™ pump. LED displays yellow when the PolyCold™ is cooling down or defrosting.	
PolyCold Defrost	The PolyCold™ pump has two modes: cooldown and defrost. Cooldown is automatically enabled as part of the auto pumpdown sequence. Defrost is automatically enabled as part of the auto vent sequence. When venting the chamber manually, first defrost the PolyCold™ pump, then vent the chamber.	

Process Module Screen	**Control Panels**

Fixture Control

LED INDICATORS	**Function:**
Green - indicates that the function is on and that valves are open. ***Black*** - (the LED is off) indicates the operation is not being performed. Black also indicates when power supplies and pumps are off. ***Red*** - indicates an error occurred. ***Yellow*** – indicates motion. Gray - option not available.	Controls and displays readouts on the operation of the fixture; its rotation, angle, cooling and clamping. 

Fixture Control



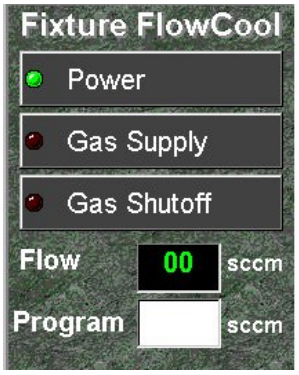
Function:

Allows the user to control the fixture's clamp, the shutter, and cooling water operation.

Clamped (Up)	The clamp moves up to secure the substrate.
Unclamp (Down)	The clamp moves down to release the substrate.
Shutter Opened	Opens the etch shutter. Green indicates the shutter is open.
Shutter Closed	Closes the shutter. Green indicates the shutter is closed.
Cooling Water	Turns the cooling water to the fixture on and off by opening and closing the chiller water valve (if chiller is installed).

Process Module Screen	Control Panels

Fixture FlowCool™

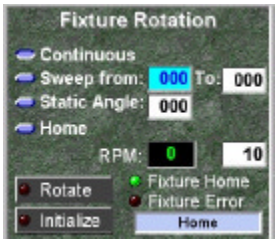


Function:

Allows the user to control the power and gas supply to the FlowCool™ option.

Power	Turns power on and off to the FlowCool™ pump.
Gas Supply	Opens/closes FlowCool™ gas supply valve. Green indicates the supply valve is open, and black indicates it is closed.
Gas Shutoff	Opens/closes FlowCool™ gas shutoff valve. Green indicates the shutoff valve is open, black indicates it is closed.
Flow	Readout of the real-time helium gas flow rate.
Program	Input for a user-selectable FlowCool™ helium gas flow rate. The flowrate must match the mass flow controller's specification, usually up to 100 sccm.

Fixture Rotation



Fixture status is indicated in the blue box (continuous, sweep, static, or home).

Function:

Allows the user to control the fixture's rotation movement.

Continuous	When selected, fixture rotates continuously.
Sweep from: to:	Perform a continuous sweep of the fixture between two angles. Enter a value between 90° and -70°.
Static Angle:	Fixture rotates to the indicated angle position and stops.
Home	Fixture rotates to the home position 90°, and is ready for a substrate load or unload sequence.
RPM	Black box readout indicates current fixture speed settings in rotations per minute (rpm). Enter a value in the white box to change the fixture speed. Maximum speed is usually 15 rpm for a standard configuration.
Rotate	Turns rotation capability on and off. Green indicates rotate is on.
Initialize	Click to perform an automatic initialize motion sequence 1. Fixture is tilted to the home position. 2. Fixture rotated to home position 3. FlowCool™ gas supply and shutoff valves closed (if fixture is equipped with the FlowCool™ feature. 4. Fixture clamp is in the unclamped position.
Fixture Home	The indicator is green when in the home position.
Fixture Error	The indicator is red when an error occurs during fixture rotation.

Process Module Screen	**Control Panels**	
Fixture Angle		
	Function: If not locked, allows the user to manually control the fixture's tilt angle.	
	Current	Readout of the tilt angle at which the fixture is positioned.
	New	An input field for a new fixture tilt angle.
	Locked	When green indicates that the fixture angle is locked.
	Home	When green, indicates fixture is in the home position.
Temperature Control		
	Function: To control the optional fixture heater. When gray, this feature is not installed. All fields will remain blank and new entries are ignored. 	
	Current	Readout of the present fixture temperature.
	New	An input field used to change the temperature.
	Power	Turns fixture heater power on or off.
	Idle	The heater is on but is not heating the fixture.
Magnetic Chuck		
	 Function: To control the optional magnetic orientation feature. When gray, this feature is either not installed or is not enable through the Process Create screen. All fields will remain blank and new entries are ignored.	
	Use Magnetic Chuck	Check this option to enable the magnetic orientation feature.
	0°	Click on this radio button to position the magnetic orientation at a 0° degree angle, with respect to the fixture's home position.
	90°	Click on this radio button to position the magnetic orientation at a 90° degree angle, with respect to the fixture's home position.

Process Module Screen	**Control Panels**

Target Control

Function:

Controls and displays target operation, target material, and target cooling.

Target Position

Displays the current material used on the target as assigned through the Configuration screen. Note that a GMR-type system may have up to six targets. The first target position is preset at the factory as the Home position.

Error - If the error light is red it indicates a target rotation error has occurred.

Tilt Angle

Current	Displays the angle at which the target position is presently set. A new value may be entered in the blank box.
Home	If the indicator is green, the target is in the Home position.

Tilt Shutter

Shutter Open	If the indicator is green, the target shutter is in the open position.
Shutter Closed	If the indicator is green, the target shutter is in the closed position.

Target Water Valve

Indicator lights is green when house water is flowing to the target.

Process Module Screen	**Control Panels**

Process Control and Process Status

Function:

The Process Control sub-menu provides quick access to process control functions without having to exit the Process Module screen. For full process editing capabilities, access the Process Control screen.

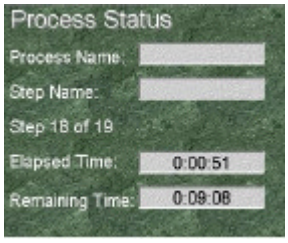
Process Control

Function:

Allows the user to manually regulate a process that currently underway or has been halted.

Run	Runs the currently selected process.
Abort	When selected turns red and stops the current process.
Continue	Continues the process after a Stop command was issued.
End Current Step	Ends the currently running step and continues next step.
On Line	Puts the system on line, that is, the front end and the process module are communicating and ready for commands.
Off Line	Halts the system. The indicator area below the Off Line control button provides a status of the currently selected process. In this example, "Stopped" indicates the current step has been stopped due to a stop command or error condition.

Process Status



Function:

Displays the status of the process that is currently running.

Process Name	Displays the name of the current process.
Step Name	Displays name of currently running step.
Step # of #	Displays the current number of step and total steps.
Elapsed Time	Time expired since the beginning of the process.
Remaining Time	Time left until the end of the current process.

Configuration Screen

Caution!

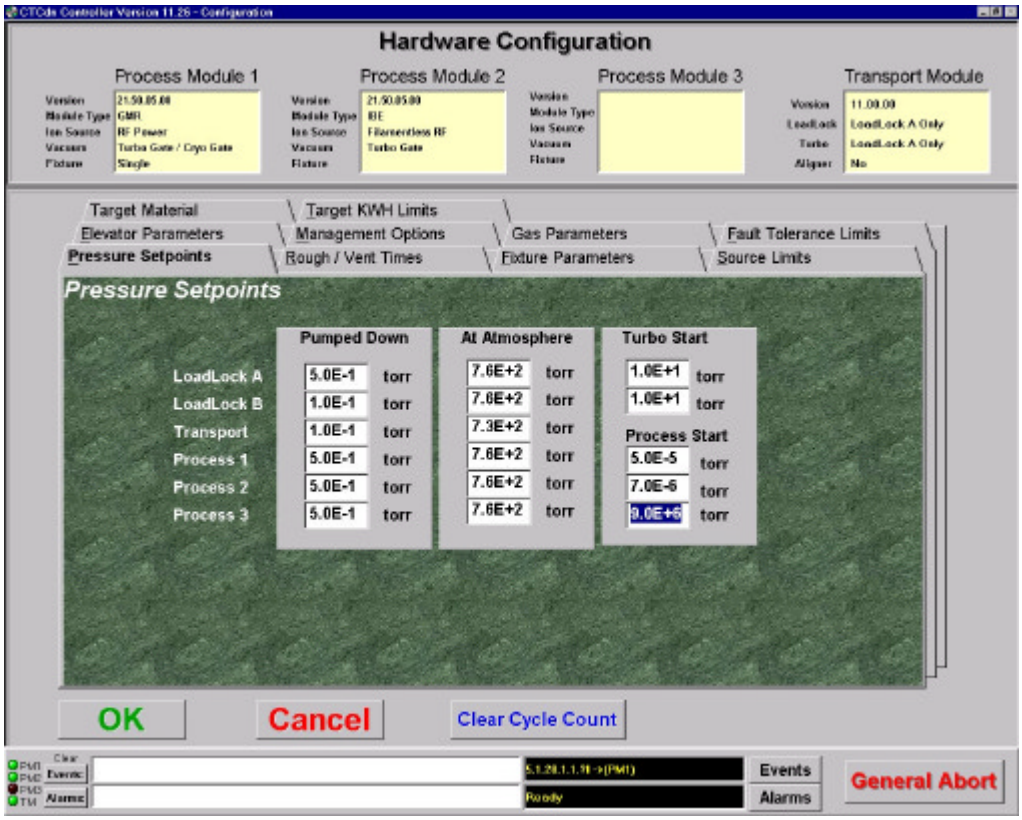
Failure to follow all safety instructions prior to using the system in the Unprotected mode or manual mode can result in damage to the system and personal injury.

Use of the system in the Unprotected mode overrides all interlocks and precautions.

Any misuse of user privileges may result in warranty implications with dollar and time costs to the user and Veeco Instruments.

Function:

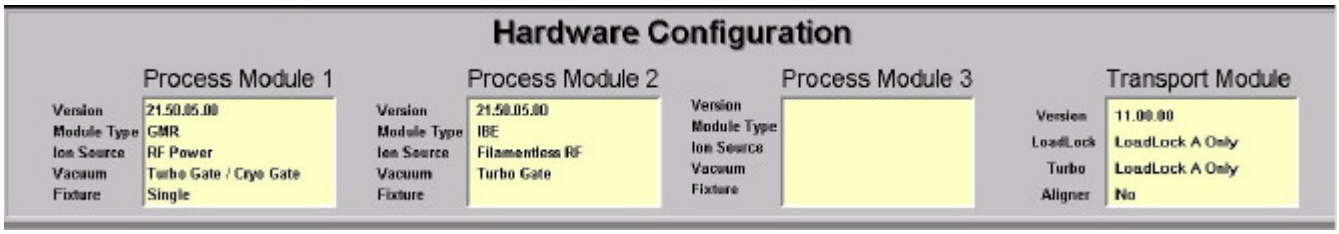
This screen contains the parameters and operating options customized for each system. The Configuration screen is intended for users with a privilege level of Supervisor or above.



Clicking on **Cancel** or **OK** returns the user to the Main Menu.

Clear Cycle Count clears the cycle counter. The Cycle Counter counts the number of times the arm has extended into and retracted from the process module.

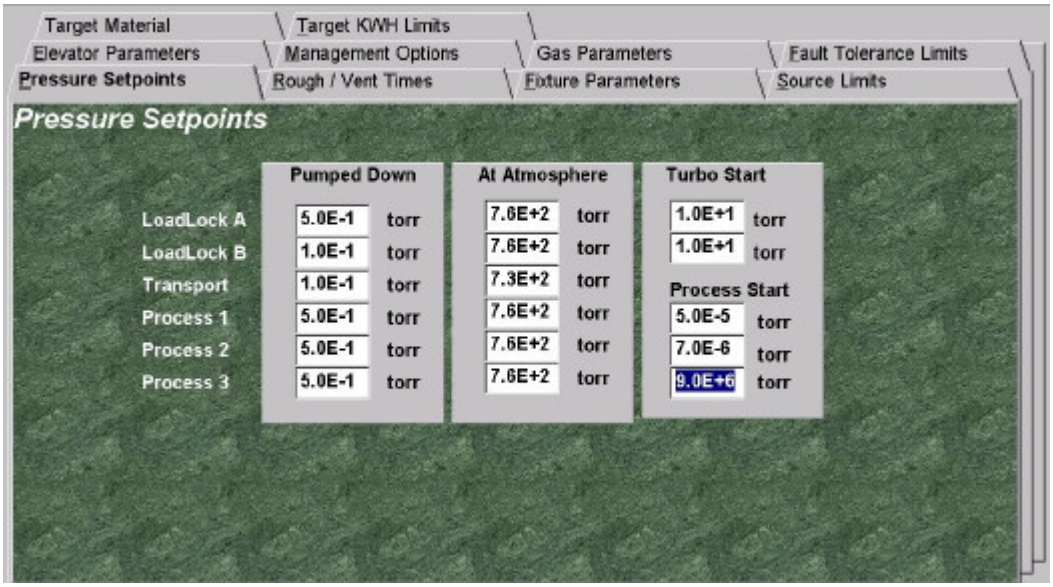
Configuration Screen	**Understanding the Configuration Screen**



This is an example of how the Hardware Configuration screen's top panel may look for a Cluster tool IBD/IBE system.

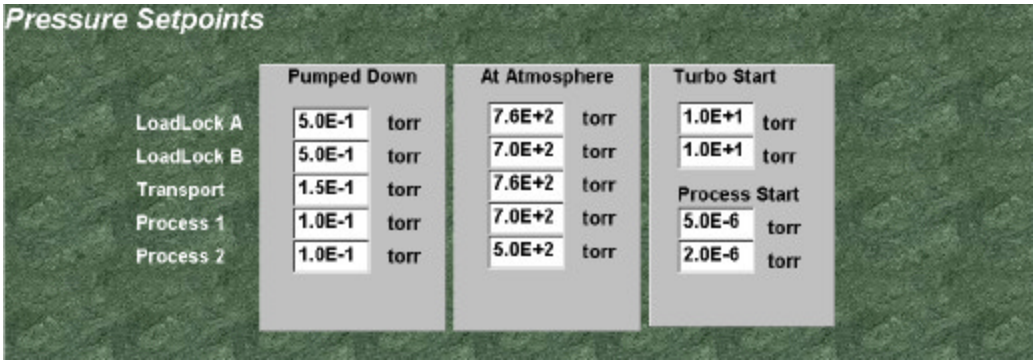
Title	Legend	Function
Process Module 1, or 2	Version	Displays the Process Module software version installed on the system. **This information is vital - in case of a software problem, have this number handy when contacting Veeco Service. The software version number is also available at the sign on/off screen, under the About Me option.**
	Module Type	Defines the type of process module used as an IBD (Ion Beam Deposition), or as an IBE (Ion Beam Etch) module.
	Ion source	Displays the type of Plasma Bridge Neutralizer (Filament or Filamentless) and the source type used by the system (RF type).
	Vacuum	Displays the type of pumps and gate valves installed for the process module.
	Fixture	Displays the word single indicating the fixture type.
Transport Module	Version	Displays the Transport Module software version installed on the system. **This information is vital - in case of a software problem; have this number handy when contacting Veeco Service.**
	Loadlock	Displays loadlock configuration (single or dual).
	Turbo	Displays if loadlock chamber is equipped with a turbo pump or a cryo pump.
	Aligner	Displays "Yes" if the aligner option is installed. "No" indicates the absence of an aligner.

Configuration Screen	**Understanding the Configuration Screen**

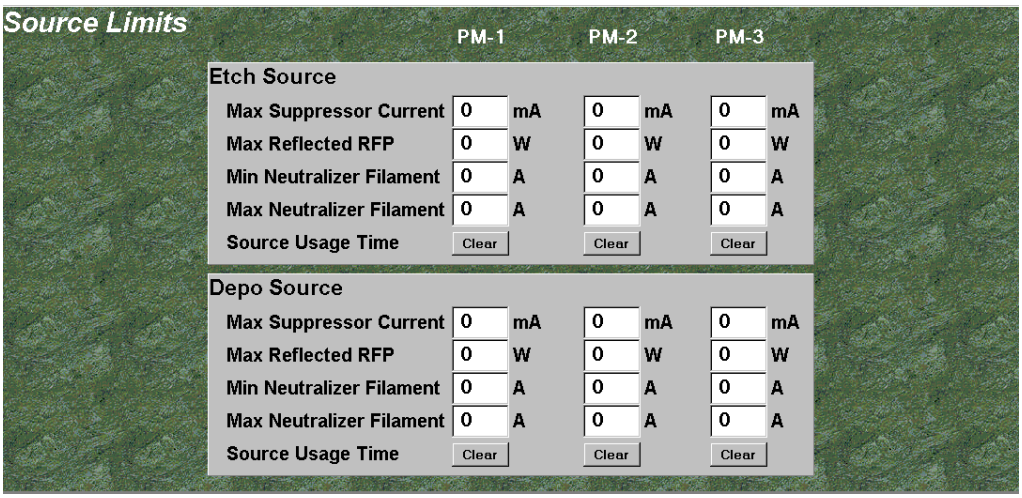


This is an example of how the bottom portion of Hardware Configuration screen may look for the Deposition Module. In this case, the Pressure Setpoints page is selected for Process Module 1. To access another page, click on the desired folder tab. A brief description of each page is listed below.

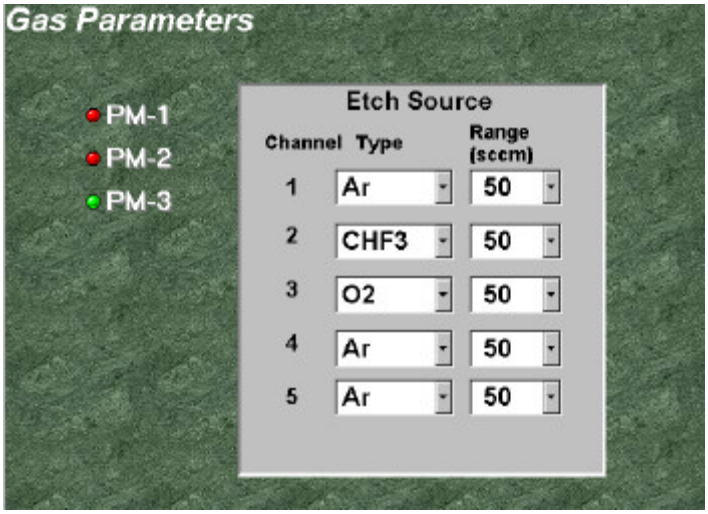
Folder Tab Legend	Function
Pressure Setpoints	Define or modify pressure range values for each chamber and for each process start.
Source Limits	Define or modify power supply values for the RF source and the PBN for each process module.
Fault Tolerance Limits	Define parameters for warning and error generation. (Refer also to the Process Create screen.)
Gas Parameters	Define or modify gas type and flow ranges for each gas channel in each process module.
Rough / Vent Times	To set the maximum chamber vacuum rough and vent times for each chamber before causing a system timeout error.
Elevator Parameters	To set or modify the number of available slots in the cassette, and the pitch, offset, and find bias values. Varies by cassette type..
Fixture Parameters	To set or modify the fixture movement parameters.
Management Options	To set system prompting and display options, and to define the Cluster overall configuration.
Target Materials	To assign the target material for each target.
Target KWH Limits	To set the limit on target material usage in kilowatt hours.

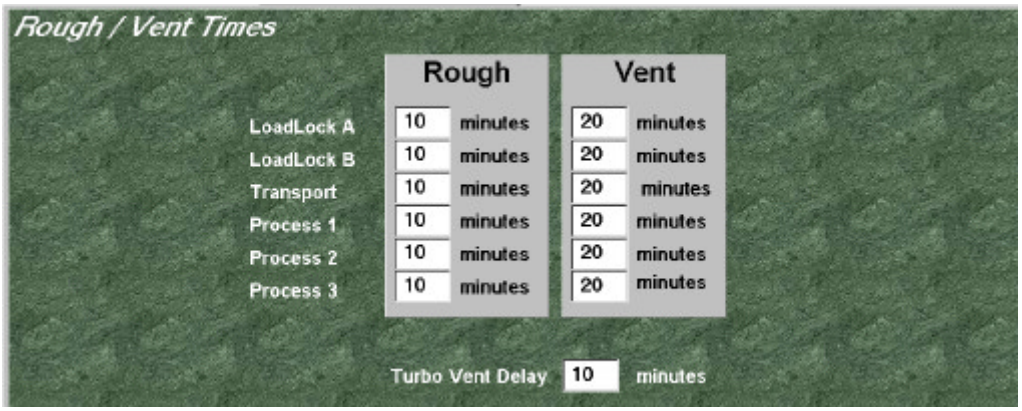
Configuration Screen	**Pressure Setpoints**
	Function: Used to set and display the pressure setpoints for all chambers in the system, and the vacuum level that must be reached before the turbo pump operates and a process may start. This screen's appearance will vary depending on the system's configuration. The illustration shown below is an example. Please use the next table as a guide to this particular illustration. To change a setpoint, click on a field and enter the new value. 

Legend	**Pumped Down**	**At Atmosphere**	**Turbo Start**	**Process Start**
Loadlock A (B)	Loadlock chamber pressure defined to the system as being pumped down.	Minimum allowable pressure level for the loadlock chamber to be defined as at atmosphere (typically 7.6.x 10^{+2} Torr).	Vacuum level that must be reached in the loadlock chamber for the turbo pump to start.	
Transport	Robot arm chamber vacuum pressure that is to be considered at vacuum.			
Process 1 (2)	Process module pressure defined to the system as being pumped down.	Minimum allowable pressure level for the process module to be defined as at atmosphere (typically 7.6.x 10^{+2} Torr).		Vacuum level that must be reached in the process chamber for a process to start.

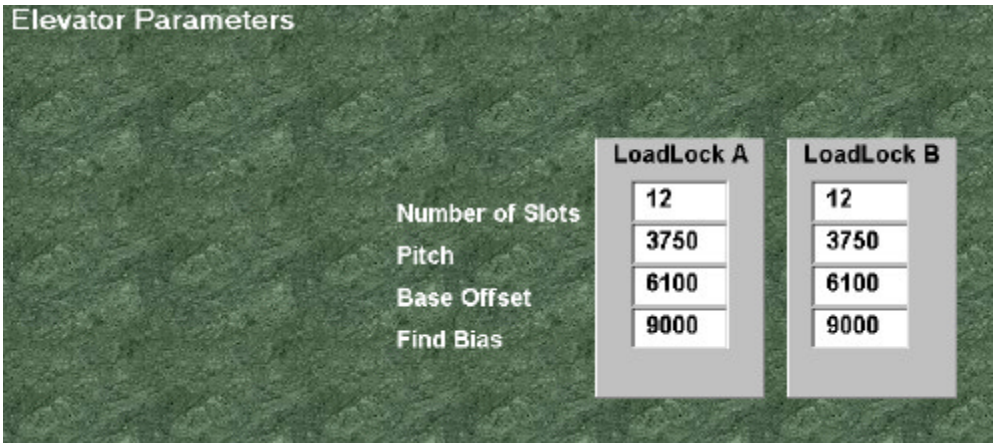
Configuration Screen	**Source Parameters**
	Function: This screen defines the power and current levels for the sources and for the PBN's for each process module. To change any of these values, position the cursor in the desired field, and enter the new parameter. 

Legend	**Function**
Max G2 Current (mA)	The maximum current that can flow through the suppressor grid before an error is generated.
Max Reflected RFP (W)	The maximum allowable reflected power value that the system will operate on, which, if exceeded, will generate an error message. The value is in Watts.
Min Neutralizer Filament (A)	Starting current for the PBN filament that increases until thermionic emission is reached.
Max Neutralizer Filament (A)	Maximum PBN filament current allowed.
Source Usage Time	Click on the Clear button to reset the source-minutes clock in the desired process module.

Configuration Screen	**Gas Parameters**
	Function: Allows the user to assign the gas type and flow range to be used for each channel in each module. The next example shows how the options would appear in the etch module. 
Legend	**Function**
Channel	Gas channel number.
Type	The type of gas that will be used on that channel.
Range	The value (rating) of the MFC being used. A gas type or range may be selected from the pull down menu. If the value is not there, the desired value can be entered through the Edit Box. The gas type must also be entered in the *CALFACT.COM* file with the gas calibration factor. The range must be the same as the MFC rating. **Note :** If the gas type was not on the list, contact Veeco Instruments for instructions on how a proper correction factor is entered.

Configuration Screen	**Rough/Vent Times**
	Function: This section of the Configuration Screen allows the user to set the maximum rough and vent times allowed by the system before timing out and generating an error. 

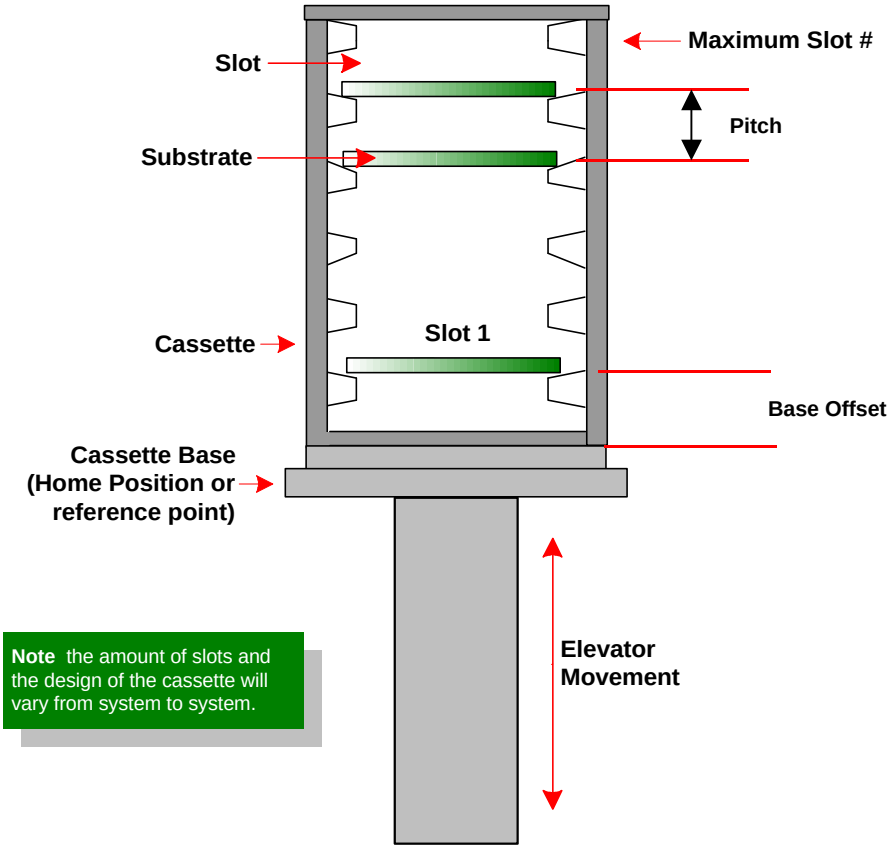
Legend	**Rough (in minutes)**	**Vent (in minutes)**
Loadlock A/B	Maximum allowable time for the specified loadlock chamber to reach the rough pressure level (defined in the *Configuration Pressure Setpoints* screen) during an auto-pumpdown procedure.	Maximum allowable time for the specified loadlock chamber to vent to atmosphere during an auto-vent sequence.
Transport	Maximum allowable time for the robot arm chamber to reach the rough pressure level as defined in the Pressure Setpoints screen.	Maximum allowable time for the robot arm chamber to vent to the pressure as defined in the Pressure Setpoints screen.
Process 1, 2, or 3	Maximum allowable time for the Process Chamber to reach the rough pressure level as defined in the Pressure Setpoints screen.	Maximum allowable time for Process Chamber vent to the pressure setpoint defined in the Pressure Setpoints screen.
Turbo Vent Delay	The time in minutes between the turbo pump turning off after an auto-vent and the opening of the vent valve.	

Configuration Screen	**Elevator Parameters**
	Function: This screen is used to assign the cassette's number of slots, and the cassette's pitch, base offset and find bias values for each of the installed loadlocks. 

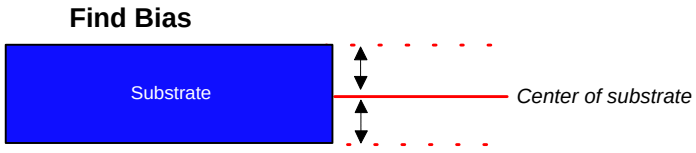
Legend	**Function**
Number of Slots	Total number of slots in the cassette. Varies with customer requirements.
Pitch	The distance between each substrate (center to center).
Base Offset	The distance between the bottom of the cassette base and the bottom of the first substrate.
Find Bias	The distance from the center of the substrate to above and below the substrate. This distance is used to determine scan tolerance.

Configuration Screen

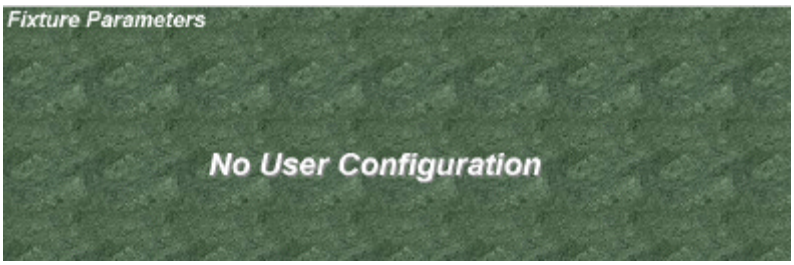
Understanding Elevator Movement



Note the amount of slots and the design of the cassette will vary from system to system.



Cassette Slots, Base Offset, and Find Bias

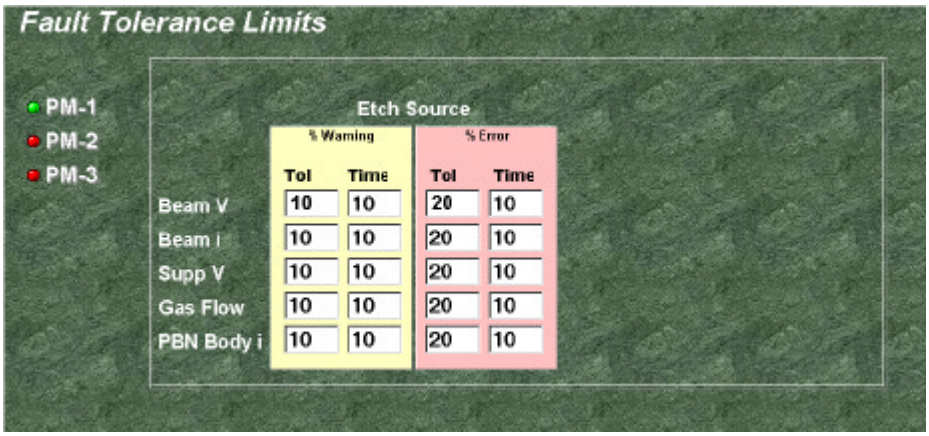
Configuration Screen	**Fixture Parameters**
	Function: These parameters are defined in an external file and cannot be changed in this screen. 

Configuration Screen	**Management Options**
	Function: This screen allows the user with a privilege level of System Supervisor or higher to define operating options.
Legend	**Function**
Use PM 1/PM2/PM3	Process Module is installed and available.
Prompt Before Scanning Cassette	If checked, user will be prompted when issuing the scan cassette command.
Prompt Before Venting	If checked, the user will be prompted when issuing the vent loadlock command.
Prompt Before Aborting	If checked, the user will be prompted when issuing an Abort command.
Use Lot Numbers	If checked, prompts the user to enter a user-assigned lot number when Run is selected.
Display PM Status & Interlock Panel	If checked will display both the status panel and the interlocks status panel on the Process Module screen.
Use Process Create GUI	Uses the Process Create screen when creating a process.

Configuration Screen	**Fault Tolerance Limits**

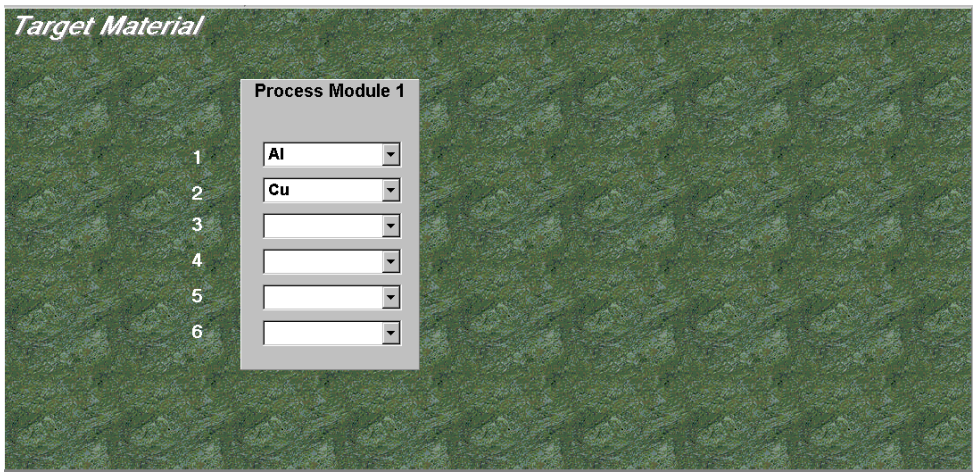
Function:

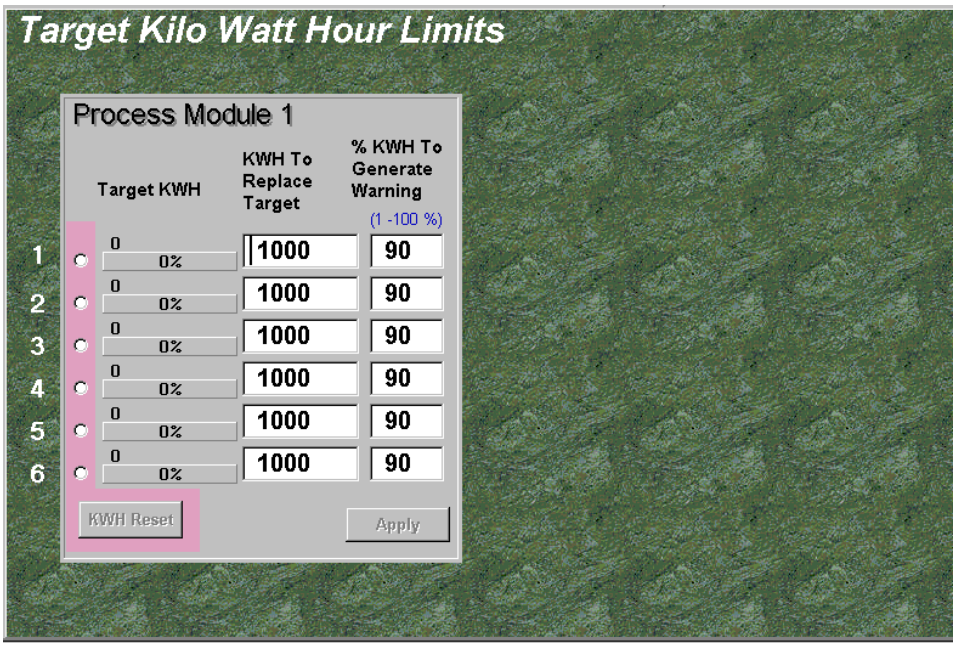
This screen defines beam, gas flow, and PBN body current fault conditions which will generate a warning or abort a process. The screen is similar for both modules.



In the above example, a warning will be generated if beam, gas, and PBN parameters in PM1 are within 10% of setpoints for 10% of the operating time. To further refine fault detection, an error condition (abort) will be generated for the same parameters if they are within 20% of the setpoint for 10% of the operating time.

Fault detection will only be enabled if the Fault Tolerance options are selected in the Process Create screen.

Configuration Screen	**Target Materials**
	Function: This screen defines the target materials for each target in the IBD module. Up to six target materials may be assigned, one for each target on the turret.  Each dropdown menu will contain a list of target materials that may be used on the target. This list is customer-specified and is programmed accordingly from the factory.

Configuration Screen	**Target KWh**
	Function: This screen defines limits on target usage in kilowatt hours. It is also used to define when to generate a warning before the target material needs to be replaced.  Up to six targets may be assigned replacement times. The user selects the target by clicking the radio button next to the target number, and then assigns the desired parameters.
Legend	**Function**
***X*%**	Percentage of the current target usage. In this example, it is 0% (not used at all).
KWH To Replace Target	Used to define the upper usage limit in kilowatt hours. In the sample shown, it is 1000 KWh.
%KWh To Generate Warning	A percentage used to define when a warning should be generated. In this example, a warning will be generated when the time reaches 90% of the defined kilowatt hours.

Schedule Screen

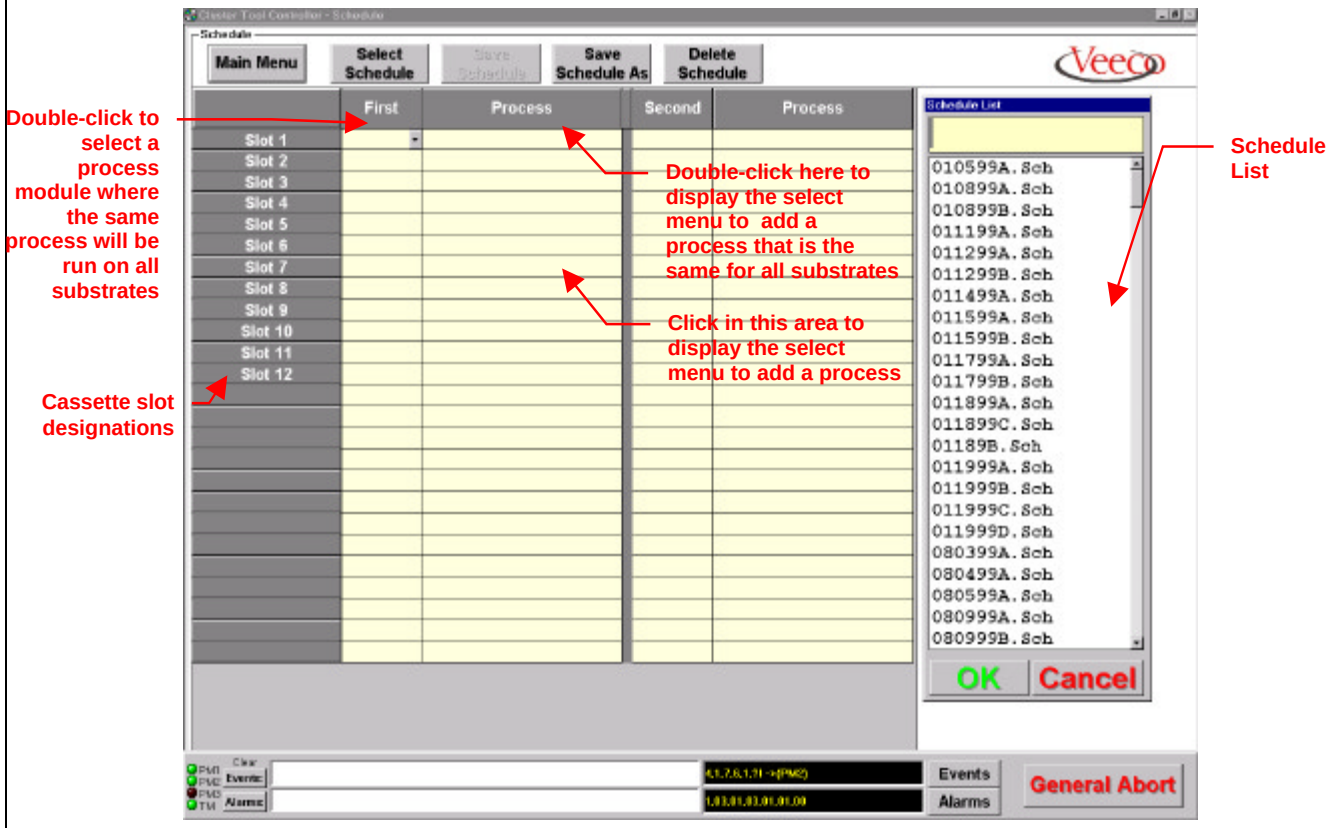
If both process chambers are the same type, then the second process section will not be displayed. The second process section is used only when the chambers are different types.

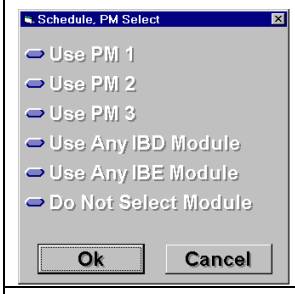
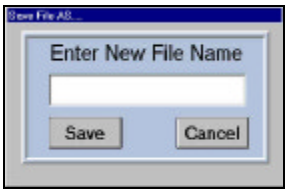
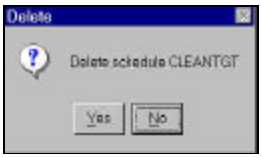
Function:

This screen allows the user to create, edit and delete schedules. A schedule is the list of the substrates (in different slots), the name of the process, and chamber in which the process will be run.

Scheduling allows different processes to be run on the same substrate by moving it **first** into a PM, running a process and then **second**, moving it to another Process Module and running a different process.

The Schedule Screen displays the name of the processes to be run first and second. When the process is complete, the substrate is returned to its assigned slot in the cassette.



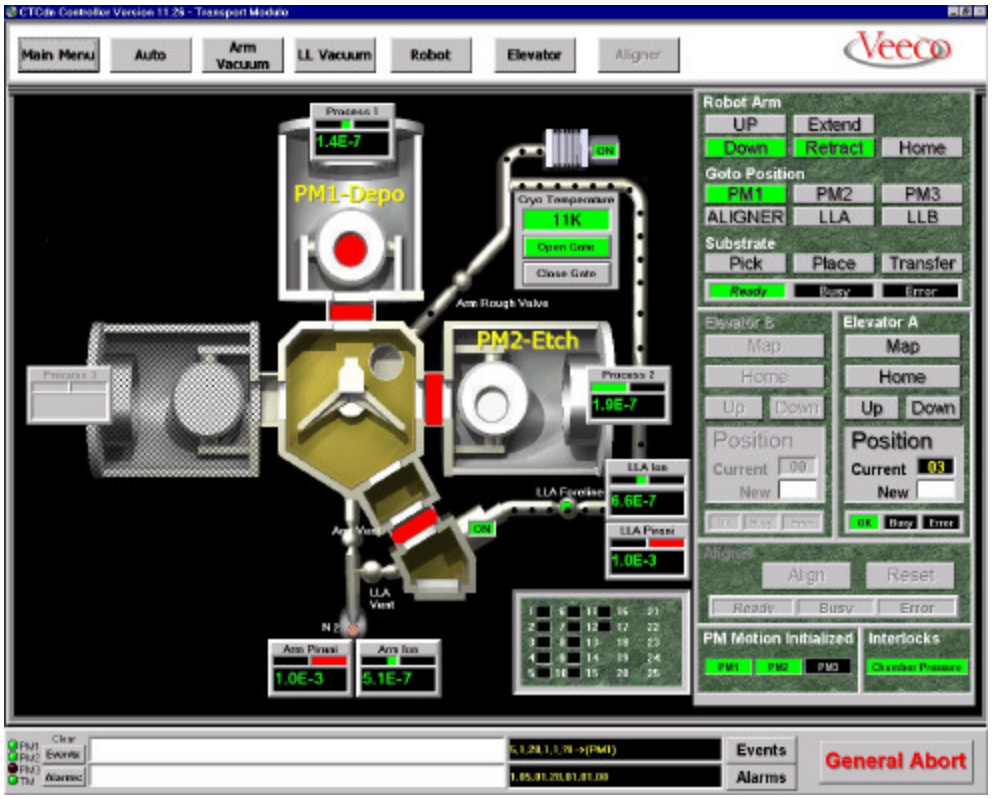
Schedule Screen	**Schedule Procedures**
	**PM Select Screen** The screen shown on the left displays when the user double-clicks on the First column on the Schedule Screen. A selection in this screen will define the module in which the same process will be performed on all substrates.
	Select an Existing Schedule 1. Click on **Select Schedule.** A list of previously created schedules is displayed. 2. Click on the desired schedule.
	**Save a Schedule As** 1. Display the schedule to be saved. 2. Click on **Save Schedule As**. 3. Enter new file name (maximum of 8 letters and extension). 4. Select **Save**.
	**To Delete a Schedule** 1. Display Schedule to be deleted. 2. Click on **Delete Schedule**. 3. Click on **Yes** to delete schedule. **Once a schedule is deleted it cannot be restored**.
	Save a Schedule 1. Display the Schedule to be saved. 2. Display Schedule to be saved. 3. Click on Save Schedule.

Transport Module Screen

The screen shown depicts a Cluster tool with two process chambers, a robot arm chamber, and two loadlock chambers.

Function:

The Transport screen controls the operation of the robot arm and elevator assemblies, and the aligner (if installed). The Transport Module Screen is displayed to all users. Access to sub-menus and operations depend on assigned privilege levels.



Transport Module Screen	**Understanding the Transport Module Screen**

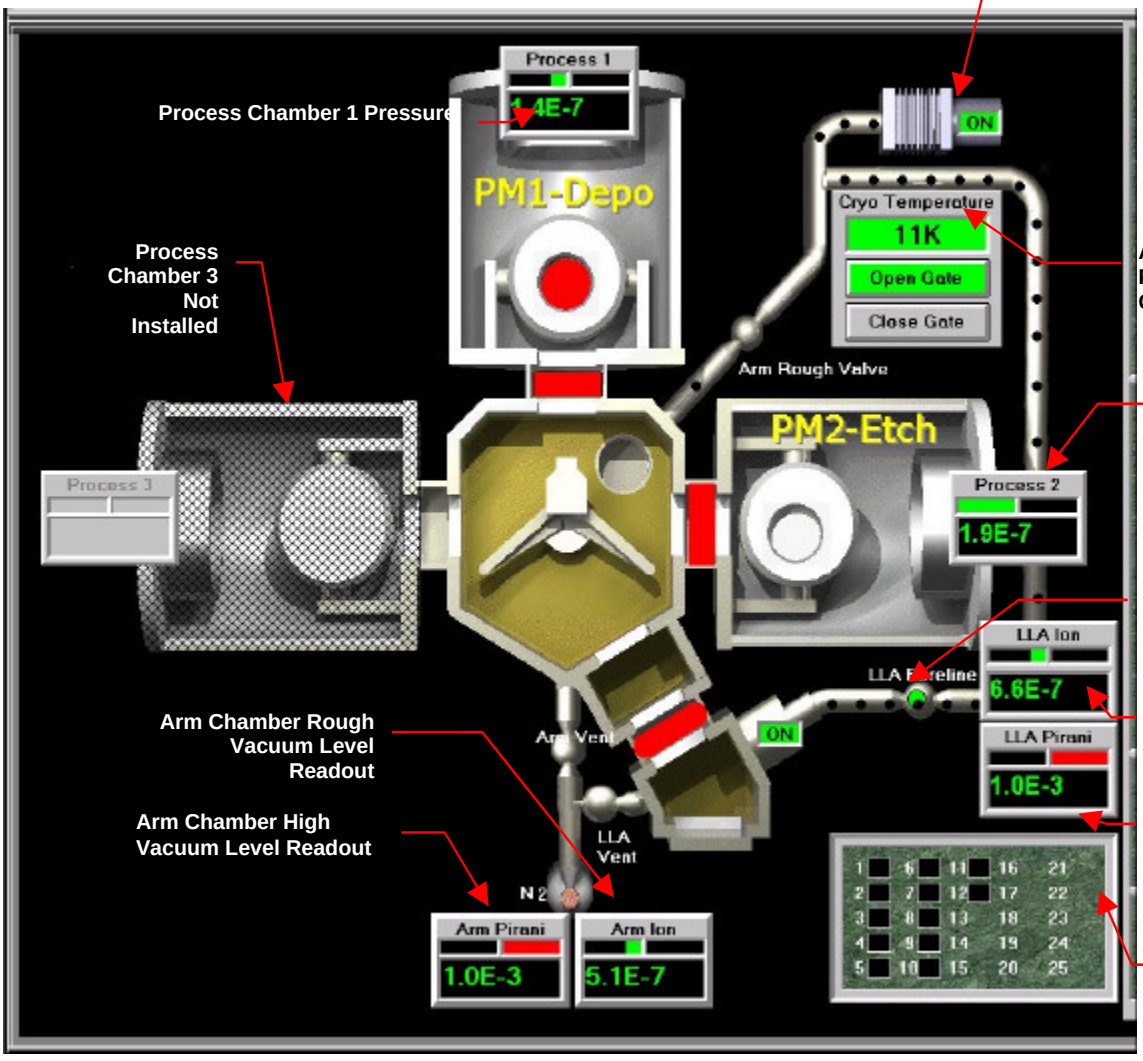
The Transport Module screen provides the user with real-time system information and allows the user to change some of the module's parameters. As a result of the system's complexity, the Transport Module screen is very intricate. To simplify this screen, it is easiest to separate it into distinct categories. The categories and their functions are listed in the following table.

Category	Function	General Appearance
Buttons Bar	Access a Control Panel or the Main Menu. This portion of the screen is static.	 *In this example the Main Menu is selected. Other options are Auto, Arm Vacuum, Loadlock Vacuum., Elevator, and Aligner (if installed).*
Indicators	Display various operations, options, and processes indicated by color.	In this example, the green indicator lights show that the robot arm is down and retracting to the home position.

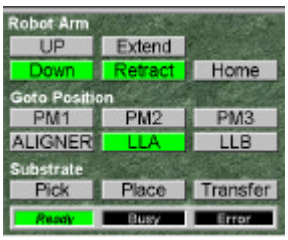
Transport Module Screen	**Understanding the Transport Module Screen**		
Category	**Function**	**General Appearance**	
Indicators	**Color**	**Meaning**	
	Green	Green indicates the operation is currently being performed. Green also indicates valves are open, power supplies are on, and vacuum pumps are on.	
	Black	Black indicates the operation is not being performed. Black also indicates when power supplies and pumps are off.	
	Red	Red indicates an error has occurred.	
	Yellow	Yellow indicates a device is between two states or busy. For example, the robot arm is moving, or the turbo is not up to speed.	
	Gray	Gray indicates the option is disabled.	
	For valves, open is indicated in green, and closed valves are as shown as clear or blue.	Arm Foreline Valve Open	**OR** Rough Valve Closed
Status Panels With Controls	Display the condition of a given area in the module.	In this example, each loadlock elevator's status is displayed on this status panel.	
Readouts	Display vacuum levels and pressures.	A sample pressure readout.	

Understanding the Transport Module Screen

Readouts



In this example, the Transport Module is a single loadlock configuration with the Robot Arm Chamber equipped with a cryo pump with a gate valve.

Transport Module Screen	Understanding the Transport Module Screen
	Status Panels With Controls Provides the user control of the robot arm, loadlock chamber elevator functions, aligner control, and the fixture status by process module. Transport Module interlock status is also displayed, as well as substrate status, elevator position status, and aligner status. Aligner status indicators will be grayed out if the option is not installed or is disabled. In the screen on the left, green indicates the current position of the arm. In this example, the arm is in the down and retracted position, pointing towards Loadlock A.
	***Robot Arm Control Panel*** Provides the user manual control of the robot arm and displays robot arm status. These controls are of great use for testing and recovery procedures. Please review the robot arm movement concepts included in this manual before attempting to move the robot arm manually. When the status panel displays Ready, a pick, place, or transfer function can occur. If the status panel displays Busy, a task is being performed. Wait until the task is finished before attempting to give a new command. If the status panel displays Error, an error has occurred while performing a task. The component must be reset and the error corrected before further action can be taken.

Understanding the Transport Module Screen

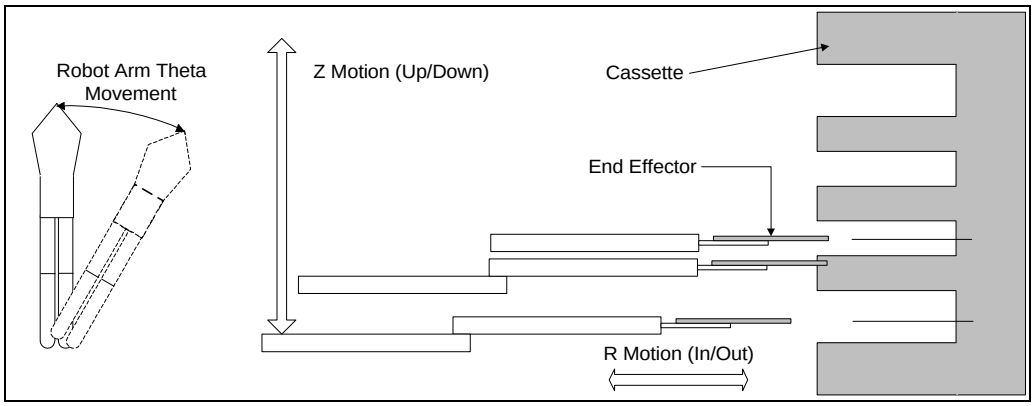
Robot Arm Movement

A preprogrammed software macro checks interlocks and moves the robot arm to perform a series of “picks” and “places.” These are movements along three axes of motion:

R Arm movement in and out of chambers (horizontal plane).

T Theta, robot arm’s angle of rotation for orientation into a process chamber.

Z Arm movement up and down.



A “pick” operation involves the motions arm down, arm extend, arm up, arm return. Also part of the pick macro is vacuum interlocks check, a valve open/closed check, elevator slot location check, and a fixture “home” condition check. A “place” operation involves arm up, arm extend, arm place, arm return.

With the R, T, and Z axes, infinite combinations of positions can be taught and saved in a teach pendant, the CDM (control display module), which is supplied with the system. The system leaves the factory preprogrammed for the specific configuration.

Transport Module Screen	Understanding the Transport Module Screen	
	Robot Arm Controls	
	Control/Status	**Function**
	Robot Arm	**Up** - Places the robot arm in the UP position. **Extend** - Places the robot arm in the extended position. **Down** - Places the robot arm in the Down position. **Retract -** **Home** - Resets the robot arm. The home position points the arm towards PM1. A Home command also clears any errors.
	GoTo Position	**PM1** - Instructs the robot arm to go to Process Module 1. **PM2** - Instructs the robot arm to go to Process Module 2. **Aligner** - Instructs the robot arm to go to the aligner. **LLA** - Instructs the robot arm to go to loadlock A. **LLB** - Instructs the robot arm to go to loadlock B.
	Substrate	**Pick** - Commands the robot arm to pick (get) the substrate from the highlighted position. Pick the substrate from either the process chamber or a loadlock chamber. **Place -** Commands the robot arm to place (put) the substrate into the highlighted position. Place the substrate into either the process chamber or a loadlock chamber. **Transfer** - Commands the robot arm to pick a substrate from one location and place it in another. To transfer a wafer, follow these steps: 1. Click on the Transfer option. 2. Click on the location to transfer the wafer from (see list below). 3. Click on the location to transfer the wafer to (see list below). LLA: Load Lock A Chamber LLB: Load Lock B Chamber PM 1: Process Module 1 PM 2: Process Module 2

Transport Module Screen

Notes:
When the cassette is mapping, Busy is displayed. Unprocessed substrates display in red.

Understanding the Transport Module Screen

Elevator Controls and Status

These controls allow the user to map the cassette, send the elevator to the home position, and jog the elevator up and down. Status is given on the current slot position and the elevator's status is also displayed. In the example shown on the left, the system is equipped with two elevators (one per loadlock).

Elevator Mapping

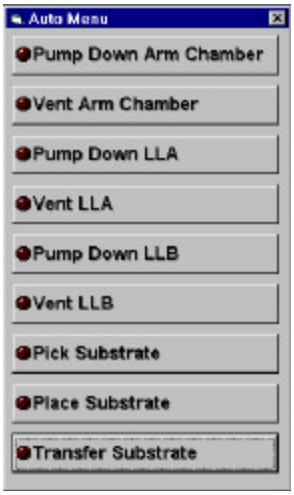
Elevator mapping follows a specific sequence as outlined below:

1. Elevator goes to the home position.
2. Elevator goes to the slot defined as 1.
3. The software erases all previous substrate status and records all the substrates as unprocessed. The *Substrate Status Screen* displays the new status.
4. The software cycles through all slots (maximum 25) and repeats steps 1-3 for all substrates detected.

Control/Status	Function
Map	Initiates the automatic mapping sequence as detailed in previous paragaphs.
Home	Send the elevator to the home position.
Up	Jog the elevator up one slot.
Down	Jog the elevator down one slot.
Position	Displays the **current** slot position. The change the slot position, enter the slot number in the **New** field.
Status Lights	**OK** - When green, elevator is ready for an instruction. **Busy** - When green, elevator is in motion. **Error** - When green, a fault has occurred with the elevator.

Transport Module Screen	Understanding the Transport Module Screen
	Aligner Control and Status The optional aligner has two control buttons and a status panel. The controls and the status panel are detailed below.

Control/Status	Function
Align Control	Activates an automatic alignment sequence on the substrate.
Reset Control	Resets the aligner.
Status Lights	**Ready** - When green, the aligner is ready for an instruction. **Busy** - When green, the aligner is in motion. **Error** - When green, a fault has occurred with the aligner.

Transport Module Screen	Auto Menu
	**Function:** Allows the user to run automatic vacuum-related operations (pumpdown and vent) for the transport module and to view module status. Also provides control of the robot arm in its movement of substrates from the loadlock chamber(s) into and out of the process chamber(s).

Transport Module Screen	**Auto Menu**

Automatic Sequences Defined

Pump Down Arm Chamber – when selected, performs an automatic pumpdown of the robot arm chamber which includes these steps:

For pumping down the arm chamber when equipped with a turbo pump:

1. If off, turn on the rough pump.
2. Open arm foreline valve (rough pumps out arm chamber).
3. When setpoint is reached, turn on the arm chamber turbo pump.
4. When turbo is up to speed, turns on ion gauge (ion gauge readback displays on Transport Screen).

For pumping down arm chamber when equipped with a cryo pump:

1. If off, turn on the rough pump.
2. Open arm chamber rough valve.
3. When setpoint is reached, close arm chamber rough valve.
4. Open cryo butterfly valve (if cryo is cold, if not cold generate error message).

Vent Arm Chamber - when selected, performs an automatic vent of the arm chamber that includes these steps:

For venting systems with a turbo pump:

1. Close arm foreline valve.
2. Turbo turns off, waits the turbo vent delay time (programmable in the configuration file) for the turbo to spin down.
3. Open vent valve, nitrogen turns on.
4. Arm chamber returns to atmosphere.
5. Close vent valve, turn off nitrogen.

For venting systems with a cryo pump:

1. Close arm foreline valve.
2. Close cryo butterfly valve.
3. Open vent valve.
4. Open vent valve, nitrogen turns on.
5. Arm chamber returns to atmosphere.
6. Close vent valve, turn off nitrogen.

Automatic Sequences Defined

Pumpdown LLA - when selected performs an automatic pumpdown of the loadlock chamber A that includes these steps:

For pumping down LLA <u>with</u> a turbo pump:

1. If off, turn on rough pump.
2. Close arm chamber foreline valve.
3. After set point is reached, turn LLA turbo on.
4. When turbo is up to speed, turn ion gauge on.
5. Open arm foreline valve.
6. Open LLA isolation valve if both arm chamber and loadlock setpoints are made and the option is enabled in the pm.ini file.

For pumping down LLA <u>without</u> a turbo pump:

1. If off, turn on rough pump.
2. Close arm chamber foreline valve.
3. Open LLA rough valve is option is enabled in the pm.ini file.
4. When setpoint is reached in LLA, close the LLA rough valve.
5. Open arm chamber foreline valve.
6. Open LLA isolation valve if both arm chamber and LLA setpoints are made.

Vent LLA - when selected performs an automatic vent of the loadlock chamber that includes these steps:

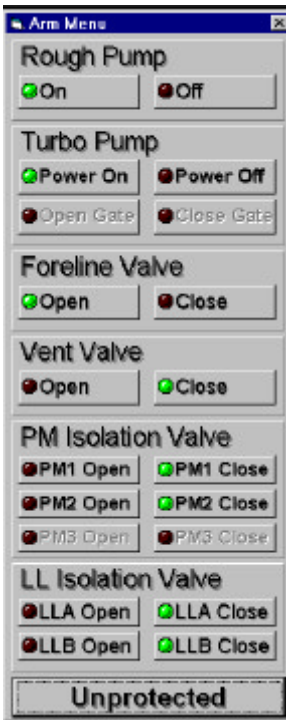
1. Turbo turns off, waits 4-5 minutes for turbo to spin down.
2. Close loadlock foreline valve.
3. Open loadlock vent Valve.
4. Loadlock chamber returns to atmosphere.

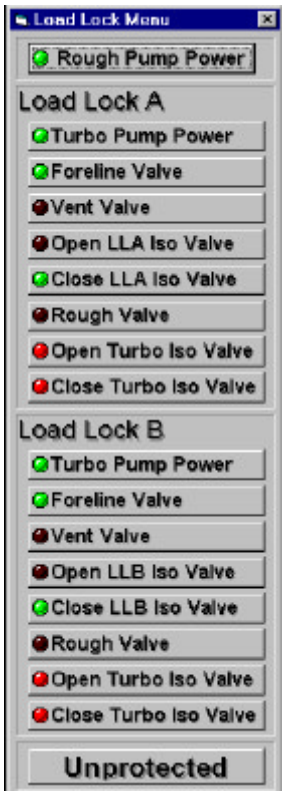
Refer to the LLA details for LLB.

Pick Substrate – when selected, instructs the robot arm to pick up a substrate from the user-designated location.

Place Substrate – when selected, instructs the robot arm to place a substrate at the user-designated location.

Transfer Substrate – when selected, instructs the robot arm to pick up a substrate from the user-designated location.

Transport Module Screen	Arm Menu
	**Function:** Allows the user manual control of the robot arm chamber's pumps and valves. **Rough Pump** - Click to power on and off to the rough pump. **Turbo Pump -** Click to power on and off the turbo pump. Note the rough pump must be on in order to turn on the turbo pump. If the turbo pump is equipped with a gate valve, the Open Gate and Close Gate controls will also be available for selection. **Foreline Valve** - Click to open and close the arm chamber foreline valve. **Rough Valve** - Click to open and close the vent valve. **PM Isolation Valve** - Click to open and close the isolation valve between the arm chamber and the selected process chamber.. Note that in this screen the PM2 option is available, but PM3 is not. **LL Isolation Valve** - Click to open and close the loadlock isolation valve. Options are loadlock A or B, open or close. **Unprotected** - Users with adequate privilege levels can put the system into the unprotected mode. “Unprotected” displays in red when the system is in the unprotected mode.

Transport Module Screen	Loadlock Menu
 When the LED is **green**, it indicates the button's description reflects the current status. In the screen above, power is applied to the rough and turbo pumps on both loadlocks, both foreline valves are open, and both loadlock isolation valves are closed.	**Function:** Allows the user manual control of each loadlock chamber's pumps and valves. **Rough Pump** **Rough Pump Power -** Click to turn power on and off to the rough pump. In dual cassette configurations, the rough pump is shared by both loadlock chambers. **Loadlock A** **Turbo Pump Power -** Click to power on and off the turbo pump. Note the rough pump must be on in order to turn on the turbo pump. **Foreline Valve** - Click to open and close the loadlock's foreline valve. **Vent Valve** - Click to open and close the loadlock's vent valve. **Open Loadlock A Iso Valve** - Click to open the isolation valve between the loadlock chamber and the arm chamber. **Close Loadlock A Iso Valve** - Click to close the isolation valve between the loadlock chamber and the arm chamber. **Rough Valve** - Click to open and close the loadlock rough valve. **Open Turbo Iso Valve** - Click to open the loadlock turbo isolation valve. If loadlock is not equipped with a turbo pump, this option will appear grayed out. **Close Turbo Iso Valve** - Click to close the loadlock turbo isolation valve. If loadlock is not equipped with a turbo pump, this option will appear grayed out. **Loadlock B** Same functions as Loadlock A. This panel will be grayed out in a single loadlock configuration. **Unprotected** Users with adequate privilege levels can put the system into the unprotected mode. "Unprotected" displays in red when the system is in the unprotected mode.

Transport Module Screen	Robot Menu

Function:

Allows the user manual control of the robot arm in its movement of substrates from the loadlock chamber into and out of the process chambers.

Robot Arm

Reset Arm (Home) - Positions the arm in the arm's home position (facing Process Module 1.

Extend Arm - Extends the arm from its current position into either the loadlock chamber or into the process module.

Retract Arm - Retracts the arm back from its current extended position, which is either in the loadlock chamber or process module, and moves it back into the arm chamber.

Arm Up - Moves the arm up when it is in either the process chamber or the loadlock chamber a predetermined amount depending on fixture type and cassette setting. This arm control button is interlocked and will not move if the Up command will cause the arm to crash.

Arm Down - Moves the arm down when it is in either the process chamber or the loadlock chamber a predetermined amount depending on fixture type and cassette setting. This arm control button is interlocked and will not move if the Up command will cause the arm to crash.

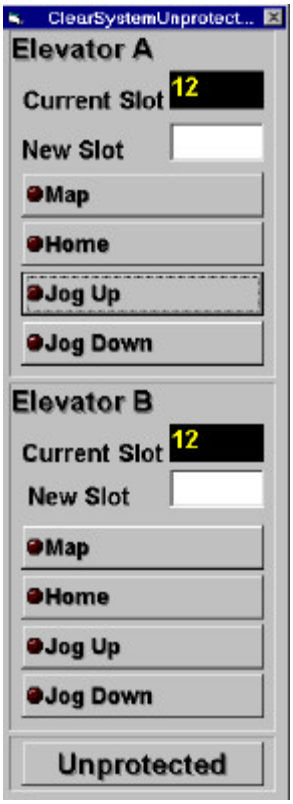
Substrate

Pick Substrate - When selected, instructs the robot arm to pick up a substrate from the user-designated location.

Place Substrate - When selected, instructs the robot arm to place a substrate to the user-designated location.

Transfer Substrate - Commands the robot arm to pick a substrate from one location and place it in another.

Unprotected - Users with adequate privilege levels can put the system into the unprotected mode. "Unprotected" displays in red when the system is in the unprotected mode.

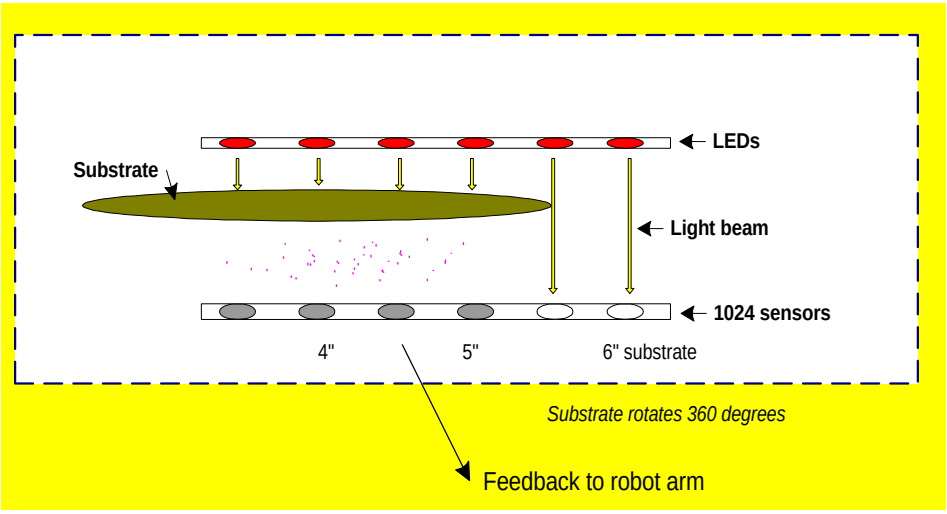
Transport Module Screen	Elevator Menu
 Before mapping note that **all** substrates in the cassette must be the same diameter and thickness. Otherwise, the pitch will be off, and the mapping will not occur correctly.	**Function:** Controls the movement of the elevator and the mapping of the cassette. In a single loadlock configuration, the Elevator B portion of the menu will be grayed out. Note the cassette can also be mapped from the Process Control screen. **Current Slot –** a readback that displays the slot number that is aligned with the robot arm. **New Slot –** enter the desired slot number to be aligned with the robot arm. **Map -** Starts an automatic sequence that goes through the following steps: 1. Elevator goes to the home position. 2. Elevator goes to the slot defined as 1. 3. The software erases all previous substrate status and records all the substrates as unprocessed. 4. The software cycles through all slots (maximum 25) and repeats steps 1-3 for all substrates detected. Mapping assigns the status of unprocessed to all substrates in the cassette. The cassette must be mapped and pumped down in order for the schedule to process a substrate. Cassette mapping must always be done after a new batch of substrates is loaded into the cassette, the cassette has been loaded into the chamber, and the chamber door is closed. **Note***:* Unprocessed substrates display in red. **Home –** positions the elevator in the home position. **Jog Up –** physically moves the cassette down so the next higher substrate number is in the home position. **Jog Down –** physically moves the cassette up so the next lower substrate number is in the home position.

Transport Module Screen

Aligner Menu

Function:

To keep the substrates aligned throughout their movement into and out of the process modules. Some systems are not equipped with this option.



The aligner's LED's sense the position of the substrate and report back to the robot arm controller to adjust the pick up of the substrate accordingly. If the substrate is too far out of position, an error will be generated.

Align – activates an automatic alignment sequence on the substrate.

Reset – resets the aligner.

Unprotected - Users with adequate privilege levels can put the system into the unprotected mode. The indicator displays in red when the system is in the unprotected mode.

To readjust the substrate that is too far out of position:

1. Place the substrate back into the cassette slot.
2. Click on the Align button to perform an auto align sequence.

Note: For critical applications, have the aligner adjusted by qualified Veeco personnel.

Events & Alarms

Do not attempt any maintenance or repair procedures without proper Veeco training.

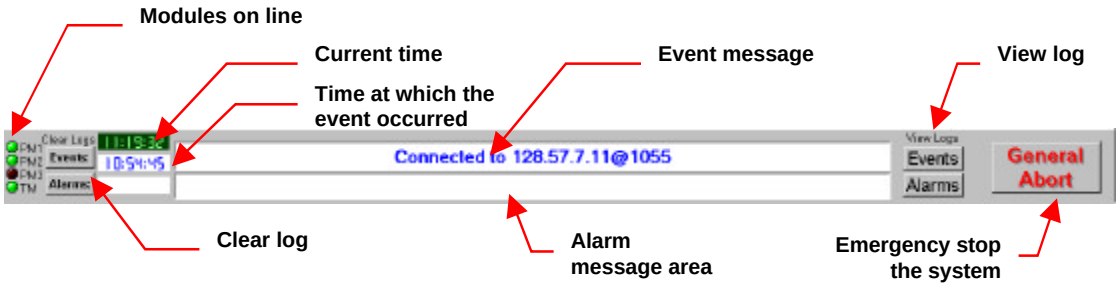
Function:

System operation is continually monitored by computer-based diagnostics. These diagnostics prevent incorrect sequencing, provide interlocks whenever required, establish safe operating levels, and monitor deviations.

The data for these diagnostics is obtained from pressure gauges, flow meters, limit switches, voltage and current meters and other devices used as sensors in critical areas throughout the system. When errors or improper conditions occur, messages are displayed on the screen. There are two types of messages:

- **Events** detail significant, but not critical messages about the system to the user and display the system's current status
- **Alarms** detail messages that indicate a failure in any automatic sequence or process.

These messages along with suggested corrective action are detailed in the tables on the following pages.



Events & Alarms Log

Accessing Events and Alarm Log

By clicking on either the events box or alarms box at the bottom of the screen, the log is displayed.

This log lists the user, date and time of event or alarm occurrence and the specific event or alarm that occurred.

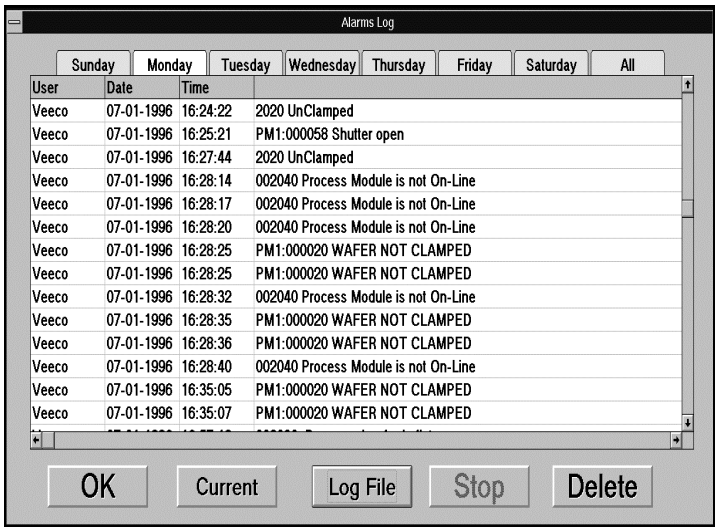
To Access The Log:

1. Click on either the Events or Alarms box at the bottom of the screen. The log will be displayed.
2. Select Log File.
3. Select a Day of the week to view the log for that day, or select **All*** for all days in the last week.

Note: Selecting **All** will download the complete list of events or alarms to the screen by a continuous scroll. This list may be quite lengthy and take some time to display the entire list. Click on **Stop** to stop the scrolling; and/or use the slide bar to scroll and view the list.

To Delete an Events or Alarm Log

1. Click on the Events or Alarms box at the bottom of the screen to display the log.
2. Click on Log File.
3. Click on Delete.
4. Click on to delete at the prompt. The log is now deleted.


Alarms Log
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
All
User Date Time
Veeco 07-01-1996 16:24:22 2020 UnClamped
Veeco 07-01-1996 16:25:21 PM1:000058 Shutter open
Veeco 07-01-1996 16:27:44 2020 UnClamped
Veeco 07-01-1996 16:28:14 002040 Process Module is not On-Line
Veeco 07-01-1996 16:28:17 002040 Process Module is not On-Line
Veeco 07-01-1996 16:28:20 002040 Process Module is not On-Line
Veeco 07-01-1996 16:28:25 PM1:000020 WAFER NOT CLAMPED
Veeco 07-01-1996 16:28:25 PM1:000020 WAFER NOT CLAMPED
Veeco 07-01-1996 16:28:32 002040 Process Module is not On-Line
Veeco 07-01-1996 16:28:35 PM1:000020 WAFER NOT CLAMPED
Veeco 07-01-1996 16:28:36 PM1:000020 WAFER NOT CLAMPED
Veeco 07-01-1996 16:28:40 002040 Process Module is not On-Line
Veeco 07-01-1996 16:35:05 PM1:000020 WAFER NOT CLAMPED
Veeco 07-01-1996 16:35:07 PM1:000020 WAFER NOT CLAMPED
OK
Current
Log File
Stop
Delete

Log Screen

OK - Returns the user to the previous screen.

Current - Displays the current entries in the log.

Log File - Brings up the Stop and Delete screen selections and displays the log of the day selected.

Stop - Stops the screen when automatically scrolling through a long log list.

Delete - Deletes the log file. Prompts with or N before deletion. Requires Process Engineer or higher privilege level.

Events & Alarms	**Lists**
	Function: Alarms detail messages that indicate a failure in any automatic sequence or process. These messages along with suggested corrective action are detailed in the tables on the following pages. These messages may indicate the onset of conditions that require service by qualified personnel. **Note** Events and alarms and their related troubleshooting guidelines cover the majority of conditions that may occur. Every effort has been made to make this list as complete and exacting as possible. However, it is possible that other fault conditions not listed may develop. **Alarms are listed numerically:** PROCESS MODULE ALARMS 0001-00240 TRANSPORT MODULE ALARMS 2001-3003

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00001	PANEL INTERLOCK	Check all panels and doors, and PBN cover - make sure all are closed properly.
00002	UNABLE TO OPEN FORELINE VALVE	Indicates the system is trying to perform a function in which the foreline valve should not open.
00003	FORELINE PRESSURE INTERLOCK	Foreline pressure too high or low.
00004	FORELINE VALVE NOT OPEN	Must be opened to turn on turbo.
00005	TURBO WATER INTERLOCK	Occurs when turbo is turned on and water is not sensed. Turn on turbo water supply.
00006	AIR PRESSURE INTERLOCK	Air pressure from facilities below setpoint. Check incoming air pressure.
00007	UNABLE TO OPEN VENT VALVE	Indicates the system is trying to perform a function in which the vent valve should not open.
00008	ROUGH VALVE IS OPEN	Indicates the vent valve tried to open. Close rough valve.
00009	CHAMBER PRESSURE IS TOO HIGH TO OPEN TURBO GATE VALVE	Chamber pressure exceeds pressure defined as the pumpdown value in the system configuration parameters. Adjust the chamber pressure to meet the setpoint .
00013	CAN'T OPEN FORELINE VALVE WHEN ROUGH VALVE IS OPEN	Close rough valve.
00014	NO WAFER IN THE FIXTURE	Occurs when trying to run a process. Load a substrate into the fixture.
00015	MOTION COMMANDS ARE DISABLED BECAUSE PM ISO VALVE IS OPEN	The system is either loading or unloading a substrate. Wait for transfer completion and for the isolation valve to close.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00016	FIXTURE NOT TILTED HOME	Occurs when trying to open clamp or extend arm with the fixture in a position other than home. Wait until the operation is complete and tilt the fixture home.
00017	CLAMP IS ALREADY DOWN	Occurs when a command to unclamp is given and the clamp is already in the unclamped or down position.
00018	FIXTURE NOT ROTATED HOME	Home fixture not rotated to the 0^{o} position.
00019	FLOWCOOL SHUTOFF VALVE IS OPEN	This valve must be closed before any further commands can be issued. Close valve.
00020	WAFER NOT CLAMPED	An attempt was made to move the fixture without clamping the substrate. Issue a Clamp command from the Process Module Fixture screen..
00021	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH2 SUPPLY VALVE	Check chamber pressure on Inficon gauge or screen display as gas supply valve channel 2 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check turbo and rough pump operation ♦ Check mass flow controller operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00022	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH2 SHUTOFF VALVE	Check chamber pressure on Inficon gauge or screen display as gas shutoff valve for gas channel 2 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check mass flow controller operation ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks

Process Module Alarms *Alarms detail messages that indicate a failure in any automatic sequence or process.*		
Alarm #	**Description**	**Meaning & Suggested Corrective Action**
00023	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH3 SUPPLY VALVE	Check chamber pressure on Inficon gauge or screen display as gas supply valve channel 3 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check mass flow controller operation ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00024	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH3 SHUTOFF VALVE	Check chamber pressure on Inficon gauge or screen display as gas shutoff valve for gas channel 3 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check mass flow controller operation ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00025	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH4 SUPPLY VALVE	Check chamber pressure on Inficon gauge or screen display as gas supply valve channel 4 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check mass flow controller operation ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00026	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH4 SHUTOFF VALVE	Check chamber pressure on Inficon gauge or screen display as gas shutoff valve for gas channel 4 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check mass flow controller operation ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00027	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH5 SUPPLY VALVE	Check chamber pressure on Inficon gauge or screen display as gas supply valve channel 5 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check mass flow controller operation ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00028	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH5 SHUTOFF VALVE	Check chamber pressure on Inficon gauge or screen display as gas shutoff valve for gas channel 5 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check mass flow controller operation ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00029	CHAMBER PRESSURE IS TOO HIGH TO TURN ON RF POWER	Check chamber pressure on Inficon gauge or screen display because there is excessive pressure in the process chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00030	CAN'T TURN ON RF POWER WHEN SOURCE IS INTERLOCKED	The source interlock is not made. Check the source power supply water flow (1 gpm), and the source water (0.67 gpm). The source RF shields must also be closed. All other interlocks must be made for the source interlock to be made.
00031	CHAMBER PRESSURE IS TOO HIGH TO TURN ON GRID POWER	The grid power supplies will not turn on until the appropriate level of vacuum has been detected. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the chamber for leaks.
00032	CAN'T TURN ON GRID POWER WHEN SOURCE IS INTERLOCKED	The grid power supplies will not turn on until the source interlock conditions are met. Check the source power supply water flow (1 gpm), and the source water (0.67 gpm). The source RF shields must also be closed. All other interlocks must be made for the source interlock to be made.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00033	CHAMBER PRESSURE IS TOO HIGH TO TURN ON NEUTRALIZER	The PBN power supplies will not turn on if the vacuum level exceeds the pumpdown setpoint. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the chamber for leaks.
00034	CAN'T TURN ON NEUTRALIZER WHEN SOURCE IS INTERLOCKED	All other interlocks must be made for source interlock to be made. Check the source and all other interlocks and make sure they are all made.
00040	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH1 SUPPLY VALVE	Check chamber pressure on Inficon gauge or screen display as gas shutoff valve for gas channel 1 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check turbo and rough pump operation ♦ Check mass flow controller operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00041	CHAMBER PRESSURE IS TOO HIGH TO OPEN CH1 SHUTOFF VALVE	Check chamber pressure on Inficon gauge or screen display as gas shutoff valve for gas channel 1 cannot be opened because of excessive pressure in the chamber. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check mass flow controller operation ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00042	FORELINE VALVE IS OPEN	Occurs when trying to open vent valve or regen the cryo with the foreline valve open. Close the foreline valve.
00043	ROUGH VALVE IS OPEN	Close rough valve. If the rough valve clicks but will not operate, check the pressure in the rough line.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00044	CHAMBER OR FORELINE PRESSURE INTERLOCK	The process chamber and/or the foreline pressure is not as programmed into the chamber's Pirani controller and as defined in the Configuration screen. The turbo pump will turn off. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the chamber for leaks.
00046	PROCESS ONGOING	The user tried to issue a command while a process was running.
00047	CAN'T LOAD PROCESS STEP FILE	The step file is either corrupt or not there. Rewrite the step or use another.
00048	HIGH CHAMBER PRESSURE	An attempt was made to perform a function for which the chamber pressure is too high. Check chamber pressure on Inficon gauge or screen display . Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00049	WAFER NOT IN FIXTURE	Occurs when trying to run a process without having a substrate in the fixture. Load a substrate and set up to run a process.
00050	NO STEP FILE	Occurs when a process is running and tries to call up a step file that does not exist. Write the step file or insert a different step into the process and try to run again.
00051	INTERLOCK ERROR	Check all interlocks. Refer to the Process Module Screen section of this manual, under *Understanding the Process Module Screen, Interlocks.*
00052	CHAMBER PRESSURE IS OUT OF RANGE	While a process was running, the process stops because the pressure is out of range for a specific step. Read ion gauge and check pressure against programmed level.
00053	SOURCE ERROR	Process source parameters are outside of programmed values defined in the system configuration setup.
00054	GAS ERROR	Process gas parameters are outside of programmed values defined in the system configuration setup.
00055	CAN NOT RECOVER	Occurs when running a process in the auto mode and an error occurs. The system tries three (3) times to recover. If it can't recover, the process aborts. Begin process over and watch for the step in which the failure occurs. Check alarm log.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00056	TILT UNREFERENCED	
00057	NOTHING TO CONTINUE	Occurs when step is aborted and Continue has been pressed. Step may be complete. Check process.
00058	SHUTTER OPEN	Shutter must be closed before a substrate can be removed from the fixture.
00059	PANEL INTERLOCK	Check that all control rack panels, chamber doors, and the PBN cover are closed.
00060	TILT MOTOR COMMUNICATION TIMEOUT	Command issued to tilt the fixture, but the command was not received by the motion board controller, and it timed out.
00061	TILT MOTOR ILLEGAL COMMAND	Command issued to tilt the fixture, but the command was not recognized by the motion board controller.
00062	INFICON COMMUNICATION ERROR -- BUSY TOO LONG	Check Inficon gauge. Make sure connections are tight. Check the front of Inficon gauge. COMM will flash when communicating with RS232 on Inficon controller.
00063	INVALID GAS TYPE	A process recipe defined a gas type not specified in the system's configuration setup.
00064	GAS CALIBRATION FACTOR FILE NOT FOUND	A process recipe defined a gas type not specified in the system's configuration setup.
00065	SOURCE INTERLOCK	Occurs when trying to run process. All other interlocks must be made for source interlock to be made. Check interlocks. Refer to the section on *Interlocks* for descriptions.
00066	FIXTURE WATER INTERLOCK	Check water flow to fixture. Water flow must be at 30 gph. If a chiller is installed, chiller water must flow at 0.8 gpm..
00067	FIXTURE ROTATION INTERLOCK	Possible causes for this error are : ♦ Fixture is jammed ♦ The substrate is not properly secured to the fixture ♦ The fixture rotation motor is bad ♦ The fuse on the motor board is blown
00068	TURBO WATER INTERLOCK	Water is not flowing to the turbo pump at 30 gal/hr or is not flowing at all. ♦ Check house water supply ♦ Check water filter ♦ Water valve defective ♦ Water line is pinched
00069	AIR PRESSURE INTERLOCK	Air pressure is below setpoint. Check that the house air supply is at 80-90 psi, and there are no obstructions or problems on the supply line.
00070	POWER UP SEQUENCE ABORTED	Automatic system power-up sequence was stopped.
00071	POWER DOWN SEQUENCE ABORTED	Automatic system power-down sequence was stopped.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00072	PUMP DOWN SEQUENCE ABORTED	This problem arises as a result of a time-out if the turbo is not up to speed in time to reach the crossover point in the process module. If a second attempt to pump down fails, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00073	VENT SEQUENCE ABORTED	Didn't vent in allotted time. Nitrogen supply may be off. Check N_2 lines for blockage.
00074	INITIALIZE MOTION SEQUENCE ABORTED	One or more conditions have not been met to complete the initialize motion sequence. Fixture did not go to the home position: ♦ Sensors are not calibrated ♦ Fixture is jammed ♦ Tilt and/or rotation motors are bad ♦ Encoder is bad ♦ Motor board or fuse is blown ♦ Motion controller is bad ♦ Sensor board is bad ♦ Power supply problems Shutter has remained closed: ♦ Sensors are not calibrated ♦ Shutter is jammed ♦ Shutter motor is bad ♦ Sensor board is bad Fixture clamp will not unclamp: ♦ Sensors are not calibrated ♦ Fixture is jammed ♦ Sensor board is bad FlowCool™ gas supply shutoff valves will not close. ♦ Check air pressure ♦ Check valve operation ♦ Check gas supply regulator

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00075	ETCH PROCESS SEQUENCE ABORTED	The process was stopped as a result of one of the following possible causes. Check the error log to help identify the problem. An arc condition occurred because of: ♦ Excessive electron current collected at the grid. This usually occurs during start up of the source when the PBN is on and the suppressor voltage is brought to zero ♦ Debris on the grids or damaged grids ♦ A sudden burst of pressure causing turbulence in the system. This causes debris to migrate between the grids and cause shorts. This type of failure is characterized by arcing occurring immediately after pumping or venting the system Process gas supply extinguished: ♦ Check gas supply and supply regulators ♦ Check gas channels and lines for obstructions or problems ♦ Check mass flow controllers for problems ♦ Check the solenoid for proper operation ♦ Check the air pressure Sudden temperature changes occurred in the chamber Chamber pressure has fluctuated: ♦ Hot filament gauge tube leads may be disconnected. ♦ Chamber liners and shields are overly contaminated.
00076	HALT PROCESS SEQUENCE ABORTED	Occurs when abort is pressed during a process.
00077	LOAD ETCH STEP SEQUENCE ABORTED	Occurs when abort is pressed during a step aborted,. Initialize fixture motion and run process again.
00078	DO PROCESS SEQUENCE ABORTED	Step aborted - initialize motion and run process again.
00079	END PROCESS SEQUENCE ABORTED	Whole process aborted, initialize motion and run process again.
00080	CONTINUE PROCESS SEQUENCE ABORTED	Whole process aborted, initialize motion and run process again.
00101	TILT MOTOR IS OFF	Check power to motor, encoder, and motion control board. Also check power supply rack.
00102	ENDPOINT NOT READY	Valid only for a system equipped with an endpoint detector. In this case, the user attempted to run a process, but the endpoint detector was not in the ready state.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00103	PROCESS PRESSURE START NOT REACHED	Process chamber pressure defined in the process doesn't reach specified level. Check the following: ♦ Process pressure specified in the recipe is within the parameters defined in the system configuration ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks ♦ Check the chamber for leaks
00104	FLOWCOOL LEAK	Helium pressure above specified limit. Helium is leaking under the substrate.
00105	VENT TIMED OUT	Vent sequence aborted. Unable to vent in allotted time. Check nitrogen supply and valve operation.
00106	PUMP DOWN TIMED OUT	Pumpdown sequence aborted. Unable to pump down in allotted time.
00107	ROTATION HOME TIMED OUT	Rotation interlock error. The fixture did not rotate 360° in allotted time. Check fixture, fixture sensors, and the fixture motor.
00108	TILT TIMED OUT	Tilt operation was not carried out in the allotted time. Check the tilt motor, the encoder, and the controller board for proper operation.
00109	CLAMP TIMED OUT	Clamping did not occur in the allotted time. Check the clamp sensors and solenoid.
00110	FAILED TO RAMP UP BEAM	Check PBN, process gas flow, and the PBN power supplies. Check the K factor. Check the beam parameters, RF power, and automatching network parameters. Check grids' electrical continuity.
00111	CRYO REGEN VALVE IS OPEN	Wait till the cryo pump regen sequence is complete.
00112	CRYO IS BUSY	Cryo is busy doing regen, vent, or purge. Wait for completion.
00113	CRYO DOES NOT RESPOND TO COMMAND	Communications problem. Check RS-232 cable connections and power to cryo.
00114	CRYO COMMUNICATION ERROR	Communications problem. Check RS-232 cable connections and power to cryo.
00115	CRYO CAN NOT EXECUTE THE COMMAND	Communications problem. Check RS-232 cable connections and power to cryo.
00116	CRYO IS INITIALIZING, TRY LATER	Wait for cryo to initialize.
00117	ROUGH PUMP POWER IS OFF	Occurs during auto pumpdown. Turn the mechanical pump's power on and/or check its wiring.
00118	CRYO GATE VALVE IS OPEN	Occurs when running a process. Close gate valve.
00119	CRYO PURGE VALVE IS OPEN	Occurs when trying to rough the cryo. Close purge valve.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00120	TURBO GATE VALVE IS CLOSED	Occurs when an auto pumpdown sequence is started and the chamber does not pump down. Open turbo gate valve.
00121	TURBO IS OFF	Turn turbo pump power on and/or check wiring.
00122	CHAMBER PRESSURE INTERLOCK	The process chamber and/or the foreline pressure is not as programmed into the chamber's Pirani controller and as defined in the Configuration screen. The turbo pump will turn off. Check chamber pressure gauge and controller for proper functioning. If these check out, pump down chamber below the setpoint defined in the system's configuration. If the chamber cannot reach the desired vacuum level, check the chamber for leaks.
00123	TURBO IS NOT UP TO SPEED	Wait for turbo pump to get up to speed before issuing the next command.
00124	TURBO IS ON	Occurs when executing an autovent command. Turn turbo pump off.
00125	LOW FORELINE PRESSURE	Check for a leak in the foreline.
00126	PROCESS CHAMBER NOT VENTED	Failed autovent sequence. Open the vent valve manually or through the Vacuum Control Panel in the Process Module screen.
00127	CRYO IS NOT WARM OR COLD	Occurs when the cryo is between the two states.
00128	CRYO IS IN REGEN MODE	Wait for cryo to complete regen sequence.
00129	CRYO IS NOT COLD	Wait for regen to finish and check cryo temp is below 20°K before issuing the next command. If this temperature is not reached after a couple of attempts, check the following: ♦ Check helium supply and regulator ♦ Check the cryo compressor for proper operation and pressure ♦ Regen may not have fully cleaned the adsorbing array. Partial pressures of noncondensables may remain ♦ Leak in the butterfly valve or in the cryo pump
00130	CRYO IS OFF	Turn on cryo through the Vacuum Control Panel in the Process Module screen. If cryo pump will not power on, check the cryo pump's power source and wiring.
00131	CURRENTLY PUMPING DOWN THE PROCESS CHAMBER	Wait until chamber is fully pumped down before issuing a new command.
00132	CRYO IS ON	Occurs when trying to open either the cryo purge valve or the rough valve while the cryo is still on. Turn the cryo off through the Vacuum Control Panel in the Process Module screen.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00133	SHUTTER FAILED TO OPEN	Occurs when running a process. Check for the following: ♦ Shutter jams ♦ Shutter sensors need to be adjusted ♦ Shutter motor operating properly' ♦ Sensor board operating properly
00134	CAN'T OPEN GAS VALVE FOR SAFETY REASONS	Occurs when cryo gate valve opens. Or can occur when oxygen is connected to a gas line (line 2 or 3) when methane is also connected to the other gas lines (lines 2 or 3). Oxygen must only be used on channels 4 and 5.
00135	TILT ANGLE IS OUT OF RANGE	The tilt angle value must be between -70° and +90°.
00136	PROCESS ISOLATION VALVE IS NOT CLOSED	The process chamber isolation valve must be closed before another command is issued.
00137	TILT/ROTATION MOTOR ERROR	Perform an Initialize Motion sequence. If this does not clear up the error, check the fixture's tilt motor and encoder.
00138	DEPOSITION/TARGET SHUTTER IS NOT OPEN	The depo beam cannot go on because the depo/target shutter is closed. Open the shutter. If it cannot be opened, check for problems in the process recipe, and check the shutter to ensure proper operation.
00139	VENT VALVE IS OPEN	The vent valve is open.
00141	NO PROCESS FILE SELECTED	Attempt was made to run a process that is not available. Select process from list of created processes.
00142	PROCESS FILE NOT FOUND	No process created with the name selected. Create a process.
00143	TARGET MECHANICAL SHUTTER FAILED TO OPEN	The target's mechanical shutter did not open.
00144	TARGET MECHANICAL SHUTTER FAILED TO CLOSE	The target's mechanical shutter did not close.
00145	TARGET TILT MOTOR IS OFF	The target's tilt angle is out of the preset limit.
00146	TARGET TILT IS UNREFERENCED	Target tilt angle cannot be referenced.
00147	ILLEGAL TARGET TILT ANGLE	Target tilt angle entered cannot be used.
00148	TARGET ROTATION MOTOR IS OFF	The target's rotation angle is out of the preset limit.
00149	TARGET ROTATION IS UNREFERENCED	Target rotation angle cannot be referenced.
00150	ILLEGAL TARGET SIDE SELECTED	Target side entered does not exist or is incorrect.
00151	TILT TARGET TIMEOUT	Target tilt timing is beyond the preset limit.
00152	TARGET SIDE CHANGE TIMEOUT	Target side change timing has gone beyond preset limit.
00153	TARGET WATER INTERLOCK	The target water interlock has not been made.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00154	PROCESS CAN NOT RUN -- RGA INTERLOCKED	Check the RGA's operation and all interlocks.
00155	DEPOSITION SHUTTER FAILED TO OPEN	Deposition shutter open sensor not communicating with the PM computer. Check the shutter's sensor and the sensor board.
00156	DEPOSITION SHUTTER FAILED TO CLOSE	Deposition shutter closed sensor not communicating with the PM computer. Check the shutter's sensor and the sensor board.
00157	ETCH SHUTTER FAILED TO OPEN	Etch Shutter open sensor not communicating with the PM computer. Check the shutter's sensor and the sensor board.
00158	ETCH SHUTTER FAILED TO CLOSE	Etch Shutter close sensor not communicating with PM computer. Check the shutter's sensor and the sensor board.
00159	CAN'T OPEN CRYO WHILE CH4 IS ON	Close gas channel 4 before issuing the next command.
00160	UNCLAMP TIMEOUT	Fixture did not unclamp in allotted time. Check the clamp sensors, check fixture air solenoid, and check the sensor board.
00161	CAN NOT OPEN DATA LOG FILE	No data log file created.
00162	MASTER TURBO PUMP IS NOT ON	Check the following: ♦ Turbo pump power must be on ♦ Turbo pump controller power must be on ♦ Foreline must be open with sufficient pressure ♦ Slave turbo pump must be on and operating properly
00164	MASTER TURBO PUMP IS NOT UP TO SPEED	A command was issued before the main turbo pump was up to speed. Wait until the pump is up to speed.
00166	MECHANICAL PUMP IS NOT ON	Check the mechanical pump's power and wiring.
00167	FORELINE PRESSURE INTERLOCK IS MADE	Pressure in the foreline is within the proper range.
00168	MASTER TURBO PUMP IS ON	Occurs when trying to open vent valve while the main turbo pump is still on.
00169	FIXTURE TILTED IN WAY OF SUBSTRATE SHUTTER	Substrate shutter cannot be moved because the fixture is obstructing it.
00170	SUBSTRATE SHUTTER IS CLOSED	Substrate shutter is closed.
00171	FIXTURE TILTED IN WAY OF TARGET SHUTTER	Target shutter cannot be moved because the fixture is obstructing it.
00172	FIXTURE TILTED IN WAY OF TARGET	Target cannot be moved because the fixture is obstructing it.
00173	CAN NOT OPEN PUMPDOWN LOG FILE	The pumpdown log cannot be opened. File may not exist or is corrupt.
00174	TARGET SHUTTER MUST BE OPEN TO MOVE FIXTURE ABOVE -14	To enter a value of over -14° as a fixture tilt angle, the target shutter must be opened if it is closed.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00175	CAN NOT MOVE TARGET WHILE TARGET SHUTTER IS CLOSED	Target shutter is open. Close the target shutter.
00176	ENDPOINT SCRIPT REJECTED	Check the script's validity.
00177	TIMEOUT WAITING FOR ENDPOINT SCRIPT TO START	
00178	ENDPOINT FAILED TO START STEP	
00179	TIMEOUT WAITING FOR ENDPOINT STEP TO START	
00180	ENDPOINT FAILED TO CONTINUE STEP	
00181	TIMEOUT WAITING FOR ENDPOINT STEP TO CONTINUE	
00182	FIXTURE TILT INTERLOCK	
00183	TARGET SIDE SELECTION INTERLOCK	Target interlock was not made.
00184	TIMEOUT WAITING FOR POLYCOLD COOLDOWN	Polycold pump did not cool down in the time allotted.
00185	TIMEOUT WAITING FOR POLYCOLD DEFROST	Polycold pump did not defrost in the time allotted.
00186	POLYCOLD START PRESSURE NOT REACHED	An attempt was made to start the Polycold pump before programmed pressure setpoint was reached.
00187	POLYCOLD ABOVE COLD SET POINT	Check the Polycold pump's operation.
00189	MUST BE AT HI-VAC TO START LEAKBACK TEST	An attempt was made to run the automatic leakback test while the process chamber was not at programmed hi-vacuum setpoint. If the chamber cannot reach this level of vacuum, check the following: ♦ Check for excessive contamination on the chamber's liners and shields ♦ Check turbo and rough pump operation ♦ Check chamber isolation valve for leaks
00190	CAN'T START A PROCESS WHILE LEAKBACK IS RUNNING	An attempt was made to run a process while the automatic leakback testing sequence was running. Wait for the leakback test to finish.
00191	PROCESS ABORTED DUE TO FLOWCOOL INTERLOCK	The process was stopped because a fault condition was found in the FlowCool™ system. Check the helium supply pressure and regulator, check the fixture water supply, and check the FlowCool™ mechanical pump.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00192	PROCESS GAS 1 OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. Process gas flow from gas channel 1 is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the mass flow controller.
00193	PROCESS GAS 2 OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. Process gas flow from gas channel 2 is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the mass flow controller.
00194	PROCESS GAS 3 OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. Process gas flow from gas channel 3 is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the mass flow controller.
00195	PROCESS GAS 4 OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. Process gas flow from gas channel 4 is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the mass flow controller.
00196	PROCESS GAS 5 OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. Process gas flow from gas channel 5 is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the mass flow controller.
00197	PBN GAS OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. PBN gas flow is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the mass flow controller.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00198	BEAM VOLTAGE OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. The source's beam voltage is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the power supplies.
00199	BEAM CURRENT OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. The source's beam current is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the power supplies.
00200	FORWARD RF POWER OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. The source's RF forward power is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the RF power supply.
00201	PBN BODY CURRENT OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. The PBN body current is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the PBN power supplies.
00202	PBN FILAMENT CURRENT OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. The PBN filament current is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the PBN power supplies. This does not apply to filamentless PBN's.
00203	SUPPRESSOR VOLTAGE OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. The suppressor grid voltage is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the suppressor grid power supply.
00204	SUPPRESSOR CURRENT OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. The suppressor grid current is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the suppressor grid power supply.

Process Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
00205	REFLECTED RF POWER OUT OF TOLERANCE	This message is displayed when fault tolerance parameters are set in the configuration setup, and if the fault tolerance warning feature is enabled through the Process Create screen. The source's RF reflected power is not within the range specified in the configuration setup. Check on the appropriate values, and change the process or settings accordingly. If the problem continues, check the RF power supply.
00206	HOT CHUCK WATER FLOW INTERLOCK	Check for problems in the fixture heater's water supply.
00207	HOT CHUCK TIMEOUT REACHING TEMPERATURE	The fixture heater was unable to reach the programmed temperature in the time allotted.
00208	HOT CHUCK TOO HOT FOR OPERATION	Temperature at the fixture heater is too high. Lower the temperature at the Process Module screen, Fixture Controls panel.
00209	HOT CHUCK COOLDOWN TIMEOUT	The fixture heater was unable to cool of within the time allotted.
00210	CHAMBER NOT IN HI-VAC	Chamber is not pumped down to the setpoint as specified in the configuration setup.
00218	ROUGH PRESSURE TOO HIGH	A command was issued that cannot be executed until the chamber is pumped down to the rough vacuum value defined in the configuration setup.
00219	MAXIMUM SUPPRESSOR CURRENT EXCEEDED	A value entered or detected for the suppressor grid current value is greater that the maximum current set in the configuration setup source parameters. Enter a value within the specified parameters.
00220	MAXIMUM REFLECTED RF POWER EXCEEDED	A value entered or detected for the RF reflected value is greater that the maximum value as set in the configuration setup source parameters. Enter a value within the specified parameters.
00221	MINIMUM NEUTRALIZER FILAMENT CURRENT NOT REACHED	The value set in the configuration setup as the minimum current requirement for the PBN filament current has not been reached. Check the values displayed in the Process Module screen. Check the PBN filament power supply.
00222	MAXIMUM NEUTRALIZER FILAMENT CURRENT EXCEEDED	A value entered or detected for the PBN filament current value is greater that the maximum current set in the configuration setup source parameters. Enter a value within the specified parameters.
00223	ILLEGAL FIXTURE ROTATION SPEED IN STEP FILE	While running a process, the rotation speed specified in the step file was found to be invalid. Correct the step and rerun the process with the correct rotation speed.
00224	ION GAGE NOT READY TO DEGAS - See PM LOG	This message will only appear if the process chamber is equipped with an ion gage.
00225	DEVICENET® FAILURE - SEE PM SCREEN	There has been a failure within the DeviceNet network. Contact a Veeco Service representative.

Process Module Alarms *Alarms detail messages that indicate a failure in any automatic sequence or process.*		
Alarm #	**Description**	**Meaning & Suggested Corrective Action**
00226	TURBO GATE VALVE CLOSED	A command was issued for a function that requires the turbo pump gate valve to be closed. This message will display only if the process chamber is equipped with an optional gate valve on the turbo pump.
00227	FLOWCOOL PRESSURE TOO HIGH - CHECK FLOWCOOL PUMP	There is a possible malfunction in the FlowCool™ pump. Check its operation.
00234	CAN'T RECOVER DUE TO PBN ERROR	A process has aborted as a result of a fault found with the PBN operation. This message will only display when fault tolerance parameters are set in the configuration setup, and if the fault tolerance error detection feature is enabled through the Process Create screen. Check the PBN gas supply, and the PBN power supplies.
00235	CAN'T RECOVER DUE TO GAS NOT ON	A process has aborted because the gas delivery system did not supply gas.
00236	CAN'T RECOVER DUE TO GAS ERROR	A process has aborted as a result of a fault found with the gas delivery. This message will only display when fault tolerance parameters are set in the configuration setup, and if the fault tolerance error detection feature is enabled through the Process Create screen. Conduct checks on the gas supplies, regulators, gas channels, and mass flow controllers. Check for obstructions on kinks in the gas lines.
00237	CAN'T RECOVER DUE TO SOURCE NOT ON	A process has aborted as a result of the source beam not igniting.
00238	CAN'T RECOVER DUE TO SOURCE ERROR	A process has aborted as a result of a problem with the source.
00239	CAN'T RECOVER DUE TO NEUTRALIZER WARNING	A process has aborted because a problem was found in the PBN.
00240	ERROR WHILE RUNNING PROCESS	An error occurred while the process was running. Check the process for possible errors in syntax or command sequences.

Cluster Tool Transport Module Alarms

Alarms detail messages that indicate a failure in any automatic sequence or process.

Alarm #	Description	Meaning & Suggested Corrective Action
002000	SIGN OFF BEFORE EXITING THE PROGRAM.	All users must be signed off before the program can be exited into Windows. Sign off and then reattempt to exit program. User requires a privilege level of Service Engineer or higher to exit program.
002001	SYSTEM IS NOT SIGNED ON.	In order to operate the system, a user must be signed on to the system.
002002	INCORRECT ID NUMBER.	The ID number entered does not match the ID number associated with the user trying to sign on. Verify correct name was selected from the sign on screen and reenter the number. If still unable to sign on, contact System Supervisor.
002003	INADEQUATE PRIVILEGE LEVEL	Trying to access a function beyond the scope of the assigned privilege level. See System Supervisor to change your privilege level, if needed.
002004	ENTER SLOT NUMBER IN THE RANGE : 1 -	Choose wafer slot number in automatic transfer.
002004	MECHANICAL PUMP IS OFF	Turn on the mechanical pump. If it does not turn on, check the power source.
002005	ARM VENT VALVE OPEN	Trying to do auto pumpdown, close the vent valve.
002006	ARM ROUGH VALVE OPEN	Trying to do auto vent, close the rough valve.
002007	LOAD LOCK DOOR IS OPEN	Close the loadlock door.
002009	FEC IS NOT READY	Front End Controller is not ready to accept the command given.
002020	UNCLAMPED	Trying to tilt when the fixture is unclamped.
002021	LOADLOCK A DOOR IS OPEN	Close loadlock door.
002023	LOADLOCK A CASSETTE MISSING	Load the cassette.
002036	ELEVATOR FAILED TO MAP CASSETTE	Verify elevator is scanning, try again to map cassette. Align wafer present sensor.
002038	ELEVATOR IS MAPPING THE CASSETTE	Wait for completion of map.
002040	CASSETTE IS NOT MAPPED	Map the cassette.
002018	ROBOT ARM IS IN THE PROCESS CHAMBER	Retract or home the robot arm.
002019	ROBOT ARM WILL NOT EXTEND	The isolation valve could be closed, or the fixture clamps could be up.
002020	ROBOT ARM WILL NOT RETRACT	Check for mechanical binding.
002021	ROBOT ARM WILL NOT GO UP	Check arm clearance.
002022	ROBOT ARM WILL NOT GO DOWN	Check arm clearance.
002023	ROBOT ARM IS IN THE CASSETTE	System is trying to map the cassette. Retract the arm.
002024	ROBOT ARM IS DOWN	Trying to put arm down when the arm is already down.
002025	ROBOT ARM IS UP	Trying to put arm up when the arm is already up.

Cluster Tool Transport Module Alarms *Alarms detail messages that indicate a failure in any automatic sequence or process.*		
Alarm #	**Description**	**Meaning & Suggested Corrective Action**
002026	CAN'T MOVE ELEVATOR, POSITION NOT DEFINED	Remap the cassette.
002027	CAN'T MOVE ELEVATOR, ROBOT ARM NOT IN LOADLOCK	Retract robot arm.
002051	LOADLOCK VENT ABORTED	Check N_2 flow and atmosphere setpoint.
002060	WAFERS NOT ALIGNED IN CASSETTE	Realign wafer in cassette.
002081	MOTION NOT INITIALIZED	Initialize fixture motion.
002100	WAFER ALREADY IN LLA, SLOT	Told to go to slot with wafer, choose a different slot.
002150	WAFER ALREADY IN PM1	Trying to load wafer. Perform unload first.
002202	CAN'T ID WAFER IN FIXTURE	Conflict in wafer id numbers.
002402	CAN'T OPEN ROUGH AND VENT VALVES AT THE SAME TIME	Close one of the valves.
002403	CAN'T OPEN ROUGH AND FORELINE VALVES AT THE SAME TIME	Open one of the valves.
002023	FLOWCOOL™ FIXTURE VALVE IS OPEN	Close valve.